Instruction Manual

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MODEL

6010A

FLUKE®

JOHN FLUKE mfg. co., inc.
SEATTLE, WASHINGTON

JOHN FLUKE MFG. CO., INC.

P. O. Box 43210
Mountlake Terrace, Washington 98043

THIS UNIT HAS
3 SEPERATE 5V
POWER SUPPLIES.
CHECK FIRST
BEFORE ANYTHING
ELSE.

MODEL

6010A

SYNTHESIZED SIGNAL GENERATOR

P/N 409714

December 1976

WARRANTY

The JOHN FLUKE MFG. CO., INC.* warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operations, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify the John Fluke Mfg. Co., Inc.,* giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate will be made before the work begins, provided the instrument is not covered by the Warranty.

"The foregoing warranty is in lieu of all other warranties, express or implied, including but not limited to, any implied warranty of merchantability, fitness or adequacy for any particular purpose or use. Fluke shall not be liable for any special, incident or consequential damages."

SHIPPING

All shipments of John Fluke Mfg. Co., Inc.* instruments should be made via United Parcel Service or "Best Way"** prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc.* Upon receipt of this report, you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc.* will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to: JOHN FLUKE MFG. CO., INC., P.O. Box 43210, MOUNTLAKE TERRACE, WASHINGTON 98043*.

* For European customers: FLUKE (Nederland) B.V.
Ledeboerstraat 27
Tilburg, Netherlands

** For European customers, Air Freight prepaid.

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Section 1

Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 6010A Synthesized Signal Generator provides keyboard signal selection within a frequency band of 10 Hz to 10.99999 (11) MHz. This frequency band is covered in two overlapping ranges. The low range, spanning 10 Hz to 109.9999 (110) kHz, provides frequency resolution of 0.1 Hz while the high range is 10 Hz to 11 MHz with 10 Hz resolution. The range is automatically selected to provide maximum resolution for the selected output frequency. It can, however, be manually placed in either high or low range using the range override controls.

1-3. Keyboard control, places the output signal level in one of four output level bands; 0.5 - 5 mV, 5 - 50 mV, 5 - 500 mV or 0.5 - 5V. An output level dial can then be adjusted to control the output within the selected band. The output level is automatically placed in the (0.5 - 5 mV) attenuation band when power is first applied to the unit.

1-4. The signal generator output frequency is displayed by an LED readout located on the front panel; each digit appearing as it is selected. The units indicator (Hz, kHz, or MHz) is also displayed when it is selected. The selected output frequency, as it is displayed on the front panel, can be modified without reselecting the entire frequency. The display decade containing an incorrectly entered digit can be selected, and the digit modified, using the frequency edit control.

1-5. The 6010A is capable of storing the keyboard information of up to ten different signal generator outputs. The stored information includes the frequency as it appears on the display, the units indicator, the output level band selected, high or low range, amplitude modulation of the output signal, and frequency modulation (optional). When a stored location is recalled, the signal generator will produce an output controlled by the information stored at that location. When a new location is selected, the generator output changes to comply with the information stored at that location.

1-6. Several options and accessories are available for use with the 6010A. Table 1-1 provides a list of the options and accessories. For more detailed information about the options see Section 6 of this manual.

Table 1-1. OPTIONS AND ACCESSORIES

MODEL NUMBER	DESCRIPTION
–01 Option	High Performance TCXO
–02 Option	Phase Lock Input
–03 Option	Frequency Modulation
–04 Option	Rear Panel Output
–05 Option	IEEE-488 General Purpose Bus Interface (byte serial bit parallel)
–06 Option	EIA Standard RS-232C Interface (byte serial, bit serial)
–07 Option	50-400 Hz Line Power
–08 Option	100V, 50-60 Hz Line Power
–09 Option	20-31 MHz Tracking Output
–10 Option	75 Ohm Output Impedance
MOO-203-631	Left or right offset rack mount with 18" chassis slides.
MO5-203-601	Left or right offset rack mount.
MO5-203-602	Center rack mount.
MO5-200-603	Dual side-by-side rack mount.
MOO-260-610	18" chassis slides

1-7. SPECIFICATIONS

1-8. The pertinent specifications for the Model 6010A are listed in Table 1-2.

Table 1-2. SPECIFICATIONS (Sheet 1 of 3)

FREQUENCY

Ranges	10 Hz to 10.99999 MHz in the high range. 10 Hz to 109.9999 kHz in the low range.
Resolution	10 Hz in the high range. 0.1 Hz in the low range.
Range Selection	Automatic; with manual override capability.
Accuracy	± 3 parts in 10^6 per year over temperature range of 0° to +50°C
Aging Rate	Less than 1 part in 10^8 per day at constant temperature or 1 part in 10^6 per year.
Switching and Settling Time	Low Range: Frequency settles to within 10 Hz of final frequency in less than 2 ms in fixed form and in less than 10 ms in free form upon update. High Range: Frequency settles to within 1 kHz of final frequency in less than 2 ms in fixed form and in less than 10 ms in free form upon update. Range Change: Less than 10 ms to be within frequency settling specifications upon update. Handshake cycle to accept one character other than update: Less than 1 ms in fixed form.
Temperature Dependence	Less than ± 2 parts in 10^6 from 0° to +50°C
Local Control	Keyboard selection of numeric data, units indicator (Hz, kHz, MHz), modulation (AM or optional FM), and Frequency Edit
Remote Standard Interface	Byte serial, bit parallel – Two programming formats Fixed Form and Free Form. Seven ASCII – defined parallel lines plus two handshake lines.
Display	Seven digit LED display
Storage	Facility to store and recall 10 front panel settings including frequency, attenuator, and modulation (on-off)

SPECTRAL PURITY

Harmonics	–50 dB from 10 Hz to 1 MHz –40 dB from 1 MHz to 11 MHz (Except, –35 dB for output levels within 2 dB of max output on each attenuation range from 5 MHz to 11 MHz.) Total harmonic distortion less than 0.3% from 10 Hz–110 kHz. Harmonically related outputs will be greater than 60 dB down on the low range.
Spurious	All nonharmonically related outputs will be greater than 60 dB below the specified output or –110 dBm whichever is greater.

Table 1-2. SPECIFICATIONS (Sheet 2 of 3)

SPECTRAL PURITY (Continued)

Signal to Phase Noise Ratio	Greater than 46 dB as measured in a 30 kHz band excluding 1 Hz centered on the carrier, including the effects of the internal standard. Residual (excluding internal standard) is greater than 50 dB down. Improvement on Low Range.
Phase Noise Spectral Density	SSB S/N ratio at the output measured in a 1 Hz bandwidth at maximum output (typical). Improvement on Low Range.

OFFSET FREQUENCY	SSB S/N
20 Hz	102 dB
200 Hz	108 dB
20 kHz	106 dB
1 MHz	130 dB

OUTPUT AMPLITUDE

Range	0.25 mV rms to 50V rms (½ watt) –59 dBm to +27 dBm into 500 ohms
Attenuation	Four selectable attenuation bands; 0.5 to 5 mV, 5 to 50 mV, 50 to 500 mV, and 0.5 to 5V. Keyboard selection of band with rotary knob control of 26 dB in the selected attenuation band.
Amplitude Accuracy	$<\pm$7% of range at 25°C and 10 kHz. Attenuator error $<\pm$0.06 dB/20 dB Step.
Frequency Response within a Band	$\pm$0.5 dB from 10 Hz to 11 MHz
Stability versus Temperature	$\pm$0.25 dB +18°C to +28°C $\pm$0.75 dB 0°C to +50°C
Amplitude Modulation	Remote analog input provides amplitude modulation, of rates from dc to 10 kHz, of the output signal. Maximum modulation is 90% $\pm$5V corresponds to 100% modulation
Remote	BNC-Connector (AM) on rear panel will program output from 0.25 to 5V rms. +0.25V dc corresponds to 0.25V rms, +5V dc corresponds to 5V rms.

AUXILIARY OUTPUTS

Square Wave	Available at the TTL OUT connector on the rear panel. Frequency is identical to main output; amplitude 0.5 to 2.4V peak-to-peak, into 50 ohms. Symmetry is typically 45% to 55%, with rise and fall times less than 10 ns.
Reference	Available at the REF OUT connector on the rear panel. Signal derived from internal reference oscillator 1, 5, or 10 MHz output; selected by internal jumpers. Output is TTL compatible square wave 0 to 3.5V peak.

Table 1-2. SPECIFICATIONS (Sheet 3 of 3)

INPUTS

External Reference	Requires a 10 MHz TTL compatible square wave with symmetry between 40% and 60%. Internal reference automatically selected in absence of an external reference.

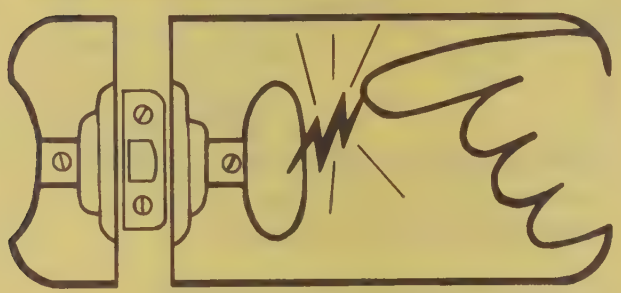
GENERAL

Operating Environment	0 – 50°C, 0 to 80% RH, 0 to 10,000 feet
Non-Operating	–40 to +75°C
Line Power	115/230V rms ±10%, 50 – 60 Hz 100V rms ±10%, 50 – 60 Hz (optional) 115/230V rms ±10%, 50 – 400 Hz (optional)
Size	13.34 cm H x 21.59 cm W x 48.26 cm D (5¼" x 8½" x 19")
Weight	11.4 kg (25 lbs.)

static awareness

A Message From

John Fluke Mfg. Co., Inc.



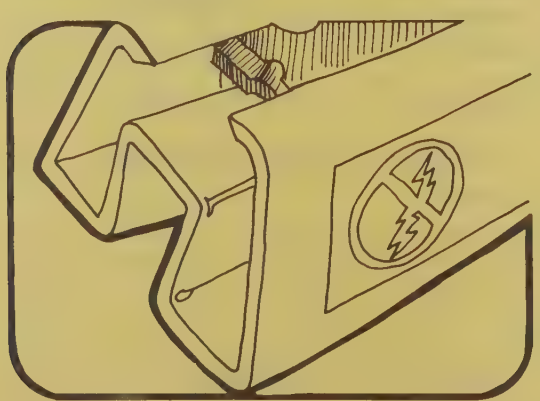
Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

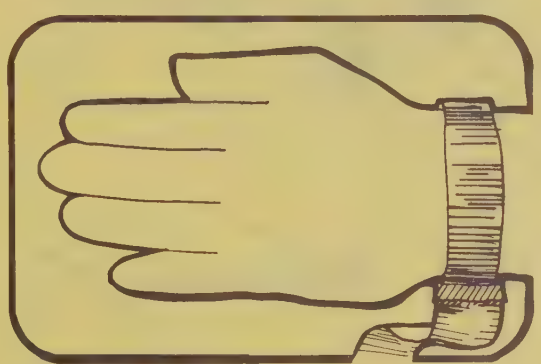
The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗".

The following practices should be followed to minimize damage to S.S. devices.

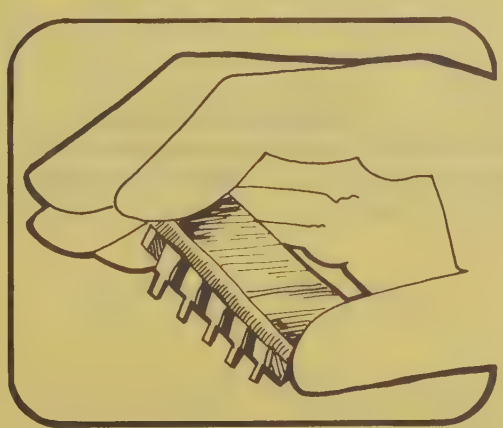
1. MINIMIZE HANDLING



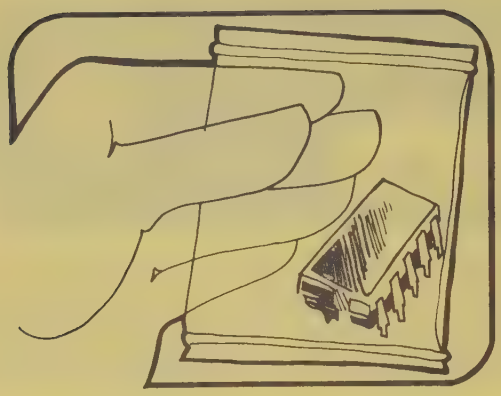
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



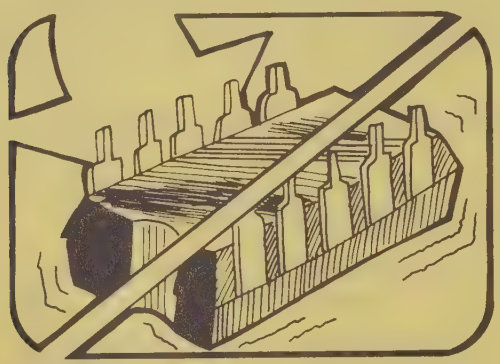
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES



4. HANDLE S.S. DEVICES BY THE BODY

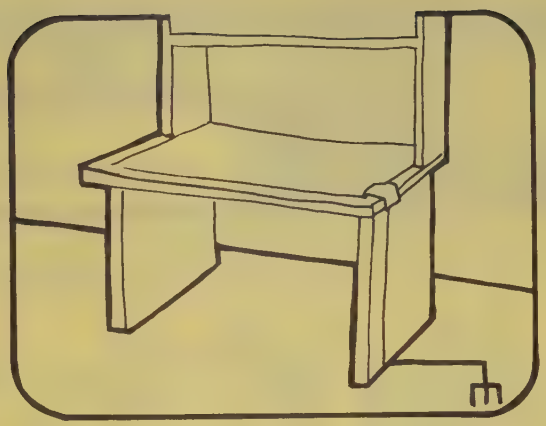


5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE

7. AVOID PLASTIC, VINYL AND STYRAFOAM IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains information essential for correct operation of the Model 6010A. Should any difficulties be encountered during operation, please contact the nearest John Fluke Sales Representative or the John Fluke Mfg. Co., Inc. A list of Sales Representatives is located at the rear of the manual.

2-3. SHIPPING INFORMATION

2-4. The 6010A was packaged and shipped in a foam packed cardboard carton. Upon receipt, a thorough inspection of the instrument should be performed to reveal any damage that may have occurred in transit. If reshipment is necessary, the original container should be used. If it is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument model number when ordering a new container.

2-5. INPUT POWER

2-6. The 6010A can be operated from either 115 or 230V ac, 50 to 60 Hz line power. A slide switch located on the bottom of the main pcb (remove the bottom dust cover for access) can be positioned to allow operation from the appropriate line voltage. The line power fuse (F1) is located in a fuse holder on the rear panel. Correct fuse size for 115 volt and 230 volt operation is provided next to the fuse holder.

2-7. OPERATING FEATURES

2-8. Location and function of all controls, connectors, and indicators are shown in Figure 2-1 and Table 2-1. More detailed operating information is provided in this section under General Operating Information.

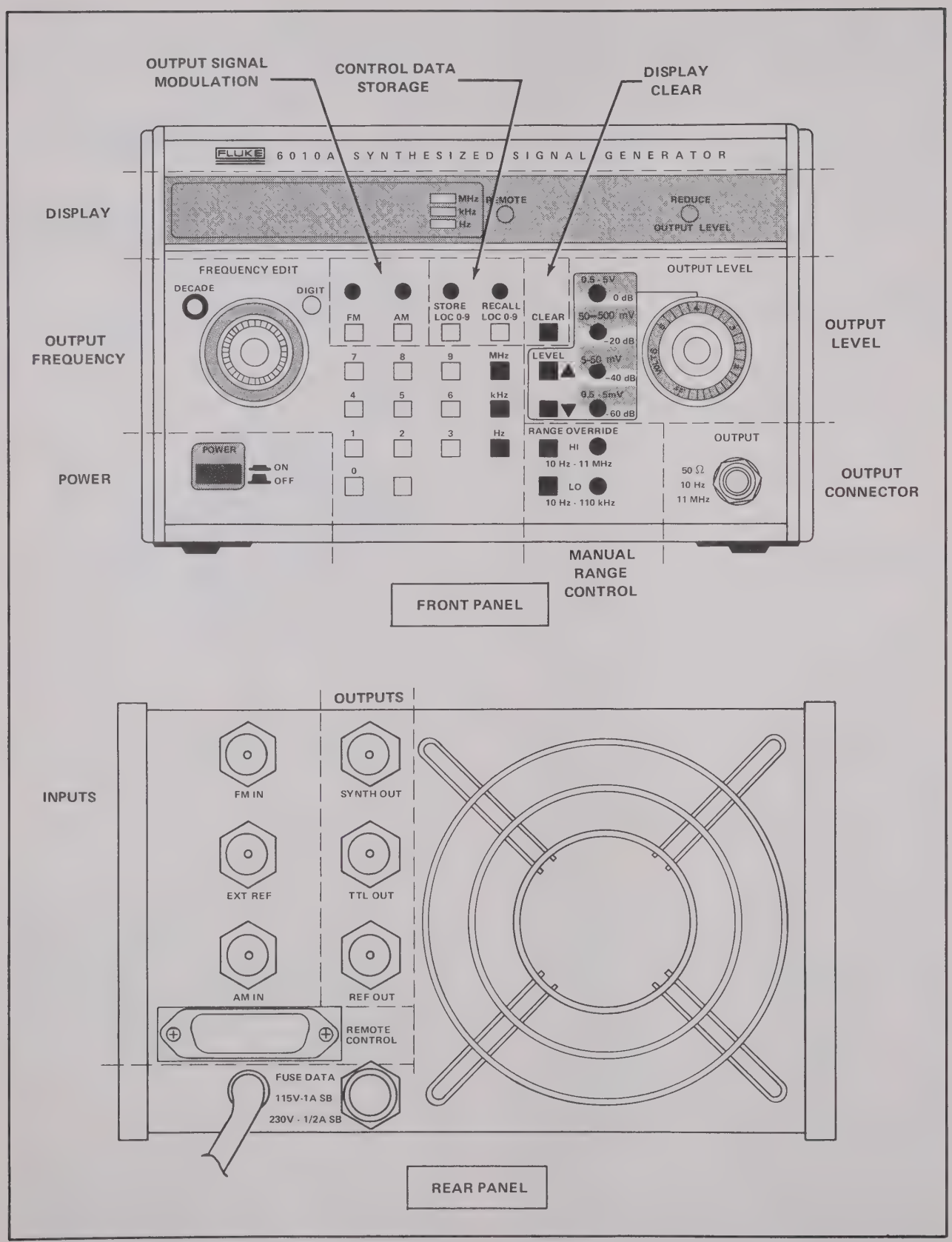


Figure 2-1. CONTROLS, INDICATORS, AND CONNECTORS

Table 2-1. 6010A CONTROLS, INDICATORS AND CONNECTORS (Sheet 1 of 2)

FRONT PANEL

POWER	Pushbutton on-off control for ac line power.
OUTPUT FREQUENCY	
KEYBOARD	Provides entry for digits, decimal point and units (Hz, kHz, MHz) of the desired frequency.
FREQUENCY EDIT	Selects a DECADE (outer dial) of the displayed frequency to allow the DIGIT (inner dial) to be changed.
DISPLAY	
DIGITS	Digitally displays the output frequency selected. The bright digit indicates the digit selected by the Frequency Edit DECADE control.
UNITS	Annunciators which illuminate to indicate the units (Hz, kHz, or MHz) of the digitally displayed frequency.
REMOTE	A single LED which illuminates to indicate that the 6010A is under remote control.
OUTPUT LEVEL	
LEVEL ▲▼	Provides pushbutton selection of one of four output level bands: 0.5 - 5 mV, 5 - 50 mV, 50 - 500 mV or 0.5 - 5V. The band selected is indicated by an illuminated LED.
VERNIER CONTROL	A rotary dial for adjusting the output level over a 26 dB range in the selected band. This adjustment range provides for an overlap in output control of about 50% of the next lowest output level band.
OUTPUT CONNECTOR	A BNC connector for the generator output.
MANUAL RANGE OVERRIDE	Two pushbuttons which allow the operator to override automatic range control by selecting either HI (10 Hz - 11 MHz) or LO (10 Hz - 110 kHz) range.
OUTPUT SIGNAL MODULATION	Provides the selection of amplitude (AM) or frequency (FM) modulation of the output signal. Desired modulating signal must be applied to either the AM IN or FM IN connector on the rear panel. To use FM, optional circuitry must be added to the instrument.
CONTROL DATA STORAGE	
STORE LOC 0-9	Provides ten locations, as selected by the keyboard digits, to store the keyboard data that controls the output. Stored data will include: output frequency, level band, range override, AM or FM and bright digit position.
RECALL LOC 0-9	Provides recall of any of the ten locations where generator output control data has been stored.

Table 2-1. 6010A CONTROLS, INDICATORS AND CONNECTORS (Sheet 2 of 2)

DISPLAY CLEAR	When pressed, this switch will cause the display to be cleared and the generator output to be reduced to zero. *NOTE* *The indicator for the output level band selected will remain on and, unless changed, will provide that output level for the next frequency selection.*
	REAR PANEL
INPUTS	
FM IN (Optional)	Provides connection for the signal used to control frequency modulation of the 6010A output signal (±5V dc corresponds to maximum modulation).
EXT REF	Provides connection for a 10 MHz TTL compatible square wave input to be used as the 6010A reference signal.
AM IN	Provides connection for the signal used to control amplitude modulation of the 6010A output signal.
REMOTE CONTROL	A 24 pin connector for ASCII format remote control inputs. All control data selectable by the front panel keyboard can be remotely programmed.
OUTPUTS	
SYNTH OUT (Optional)	Replaces the front panel OUTPUT connector to allow rear panel connection for 6010A outputs.
TTL OUT	Provides a TTL compatible output signal equal in frequency to the generator output signal.
REF OUT	Provides a 1, 5 or 10 MHz (selected by internal jumpers) TTL compatible output, derived from the reference oscillator.

2-9. GENERAL OPERATING INFORMATION

2-10. The following information is designed to acquaint the operator with the proper sequence of control manipulation required to obtain specified signal generator outputs. It is recommended that the operator perform the following procedures in order to familiarize himself with the functional capabilities of the 6010A signal generator. The signal generator output can be connected, with a 50 ohm load, to an oscilloscope so that the output signal can be observed.

2-11. Power On

2-12. The 6010A is designed to provide maximum attenuation and zero output frequency when the front panel POWER button is pressed to the ON position. Observe the front panel for the following indications when the power is first applied to the unit.

a. The most significant digit (left) should be zero; all others blank.

b. The indicator for the 0.5 - 5 mV output level band should be energized.

2-13. Output Frequency Selection

2-14. The following procedure provides examples illustrating the front panel keyboard entry for the selection of output frequencies. Digit keys 0 through 9 plus the decimal point key are used to sequentially enter the digits of the desired output frequency; starting with the most significant digit. When the frequency unit (Hz, kHz, or MHz) is selected the frequency becomes available at the output connector.

Example 1: Desired output frequency 9.8324 MHz.

a. Press the digit key 9; note the most significant digit of the display is 9.

b. Press the decimal key; the decimal should appear to the right of the 9.

c. Press the remaining digit keys; i.e., 8, 3, 2 and 4 noting that the digits appear in the display.

d. Press the MHz key. The display should show 9.83240 digits (the zero should be bright) and the MHz LED indicator should be lit. The HI range LED should also be energized.

Example 2: Desired output frequency 12.384 kHz.

a. Press the CLEAR key.

b. Press each successive digit key, plus the decimal key, noting the display shows each digit as it is pressed.

c. Press the kHz key. The display should show 12.3840 digits (the zero following the 4 should be bright) and the kHz indicator should be lit. The LO range LED should also be energized.

2-15. Edit Output Frequency

2-16. If, in selecting the output frequency, an error was made in entering a digit, that digit can be changed without re-entering the entire frequency. The frequency edit controls can also be used to make random changes to a selected frequency output. For the following description of the frequency edit control operation, use the frequency output 12.3840 selected in the previous operation.

a. Note the bright zero in the tens decade of the display (right most digit).

b. Turn the DECADE portion (outer dial) of the FREQUENCY EDIT control counterclockwise one detent position. The tens decade zero should go dim and the hundreds decade 4 should brighten. The bright digit indicates the decade to be edited. Any decade of the display can be selected for edit.

c. With the 4 in the hundreds decade selected for edit, turn the DIGIT (inner dial) control one detent position clockwise. The 4 in the hundreds decade should change to a 5.

NOTE

Counterclockwise rotation of the digit dial can reduce the selected decade and all more significant decades to zero, but cannot carry over to any lesser significant decade. Clockwise rotation will also carry over to increase the selected decade and all more significant decades.

2-17. Clear Display

2-18. The CLEAR key on the front panel allows the operator to cancel the selected output frequency in preparation for a new entry. When the CLEAR key is pressed the frequency display will show only a zero in the most significant decade with all other decades blank. The

range LEDs HI and LO should both be out after the CLEAR key is pressed.

NOTE

When the CLEAR key is pressed the generator remains programmed in accordance with the last entries. The output level, however, is reduced to —80 dBm.

2-19. Select Output Level

2-20. The unit provides keyboard selection of any one of four output level bands plus vernier control of the output level within the selected band. The band selected is indicated by an energized LED. Operation of the LEVEL select keys and the OUTPUT LEVEL vernier control is described in the following procedure. The 6010A automatically selects the 0.5 - 5 mV output level band when the power is turned on.

a. Press the LEVEL increase key (identified by the upward pointing arrow) one time. The 0.5 - 5 mV LED will go out and the 5-50 mV LED will light.

b. Press the LEVEL increase key again; the 5 - 50 mV LED will go out and the 50 - 500 mV LED will light.

c. Press the LEVEL decrease key (indicated by the downward pointing arrow) one time. The 50 - 500 mV LED will go out and the 5 - 50 mV LED will light.

d. Set the LEVEL CONTROL vernier dial to 5; as indicated on the VOLTS markings on the dial. The instrument output level under these conditions (5 - 50 mV band with 5 dialed on vernier control) would be 50 mV.

NOTE

The output level can be expressed in dBm by algebraically adding the dB value indicated by the energized LED (0 dB, -20 dB, -40 dB, or -60 dB) to the dBm value indicated on the vernier dial. The dBm equivalent of the 50 mV output selected in the above procedure would be determined as follows:

selected band (-40 dB) + vernier setting (+27 dBm) = output level -13 dBm

2-21. Range Override

2-22. Even though the range is automatically selected it is possible to manually override the range. The RANGE OVERRIDE HI or LO key can be selected before the frequency selection is entered, or after. If the frequency selected is 110 kHz or greater, the HI range will automatically be selected. The LO range override key would then be inoperative because the selected frequency is invalid for the low range. If the LO range override key were selected prior to entering a frequency of 110 kHz or greater the unit will indicate the invalid condition by showing a flashing display of the selected frequency.

2-23. Storing and Recalling a Selected Output

2-24. The 6010A provides ten locations for storing selected output data. In addition to the frequency data, the selected output level band, range override, and AM or FM operation can also be stored. Once stored the control data can be recalled to produce the desired output. The instrument operation for storage and recall is described in the following procedure.

a. Select the output signal data desired, i.e., frequency, level band, range, etc.

b. Press the STORE key.

c. Press the 2 digit key for the storage location. (2 is only an example, any digit key can be selected as the store location.)

NOTE

The control data has been stored in the location selected but the signal generator output will remain as selected until the CLEAR key is pressed or the first digit of a new frequency is selected.

d. Enter a new set of output signal data.

e. Press the STORE key and the 7 digit key to store the data.

f. Press the RECALL key then 2 digit key. The signal generator output will be equal to the data selected in step a.

g. Press the 7 digit key. The generator output will change to equal the data entered in step d.

2-25. Amplitude Modulation of the Output Signal

2-26. An analog input signal to the AM IN connector on the rear panel will provide amplitude modulation of the 6010A output when the AM key on the front panel is selected. The frequency of the signal at the rear panel AM IN connector can be from dc to 10 kHz. The frequency will determine the rate of modulation. The percentage of modulation is controlled by the level of the signal applied to the AM IN connector. A 4.5 volt peak input to the AM

IN connector will produce 90% modulation of the 6010A output signal; 2.5 volts peak, 50% modulation. The following procedure describes the amplitude modulation mode of instrument operation.

a. Select the 0.5 - 5V output level band and set the OUTPUT LEVEL vernier control to 3 (as indicated on the volts scale).

b. Select a 6010A 1 MHz output frequency.

c. Connect the 6010A output, via a 50 ohm inline load, to an oscilloscope. Set the scope TIME/DIV control to 0.2 ms and the VOLTS/DIV to 5V.

d. Connect the output of a signal generator, set for 1 kHz at 2.5 volts peak, to the AM IN connector on the 6010A rear panel.

e. Press the AM key on the 6010A front panel.

f. The scope display should show the 1 MHz signal being amplitude modulated at a 1 kHz rate. The peak of the positive half of the modulated signal will be 6.36 volts and the trough should be 2.12 volts.

NOTE

The peak value of the modulated signal will be limited at about 7.07 volts peak; i.e., it is limited to a maximum 6010A output level of 5 volts rms. Expressed as a formula.

$$\left(\frac{V_{AM\,IN}}{5} \times V_{OL}\right) + V_{OL} \leq 5Vrms$$

Where $V_{AM\,IN}$ is equal to the peak value of the input applied to the AM IN connector and V_{OL} is equal to the voltage setting on the Output Level dial.

2-27. Remote Control Operation

2-28. The 6010A offers, with the standard unit, two remote byte serial programming formats; fixed form and free form. In the fixed form mode the decimal point location is determined by the range selected; i.e., xx.xxxxx MHz in HI range and xxx.xxxx kHz in LO range. The data must be programmed by position. Each of the seven digits of display is selected by address code before the number is entered. The free form input allows the instrument to be remotely programmed essentially the same as that of the front panel keyboard entry. Each key on the 6010A front panel is represented, in the remote control code, by a unique character.

2-29. The characters used in both the fixed form and free form programs follow the ASCII format (American Standard Code for Information Interchange). The bit number and octal equivalent of the ASCII characters, used in both the fixed form and free from, are shown in Table 2-2. The bits are labeled ADB1 through ADB7 to identify them as ASCII Data Bits.

2-30. The remote control inputs are applied to the 6010A through a 24 pin connector mounted on the rear panel. Table 2-3 lists the pins and the input or output data carried on that line. The operational meaning of the data being transfered through these lines is also provided. Timing the data transfer is controlled by the DRY (Data Ready) input on pin 6 and the BSY (Busy) output on pin 7. Figure 2-2 illustrates the control of the data transfer.

2-31. FIXED FORM REMOTE INPUTS

2-32. The fixed form of remote data input is presented in Table 2-4. The data is refered to by ASCII characters. Use Table 2-2 to translate the control data to bit word form. Note that two ASCII characters are assigned to each of the seven digits of the display. One set, A through G, allows the digit data of all seven decades to be changed without affecting the 6010A output until an update command loads the data into the synthesizer latches. The second set of characters, Q through W, cause the 6010A output to update as new data is applied to each digit. Select the address character of the position, then enter the character of the selected input data. Refer to the fixed form program example for added clarification of the remote programming using fixed form entry.

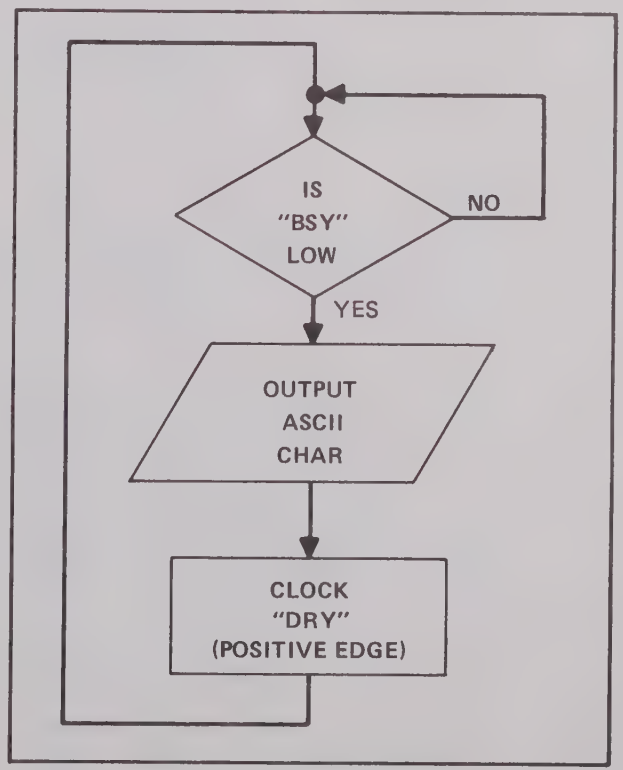


Figure 2-2. DATA TRANSFER

Table 2-2. ASCII CODE

CHAR.	ABD NO. 7	6	5	4	3	2	1	OCTAL EQUIV.
A	1	0	0	0	0	0	1	101
B	1	0	0	0	0	1	0	102
C	1	0	0	0	0	1	1	103
D	1	0	0	0	1	0	0	104
E	1	0	0	0	1	0	1	105
F	1	0	0	0	1	1	0	106
G	1	0	0	0	1	1	1	107
H	1	0	0	1	0	0	0	110
I	1	0	0	1	0	0	1	111
J	1	0	0	1	0	1	0	112
K	1	0	0	1	0	1	1	113
L	1	0	0	1	1	0	0	114
M	1	0	0	1	1	0	1	115
N	1	0	0	1	1	1	0	116
O	1	0	0	1	1	1	1	117
P	1	0	1	0	0	0	0	120
Q	1	0	1	0	0	0	1	121
R	1	0	1	0	0	1	0	122
S	1	0	1	0	0	1	1	123
T	1	0	1	0	1	0	0	124
U	1	0	1	0	1	0	1	125
V	1	0	1	0	1	1	0	126
W	1	0	1	0	1	1	1	127
X	1	0	1	1	0	0	0	130
Y	1	0	1	1	0	0	1	131
Z	1	0	1	1	0	1	0	132
0	0	1	1	0	0	0	0	060
1	0	1	1	0	0	0	1	061
2	0	1	1	0	0	1	0	062
3	0	1	1	0	0	1	1	063
4	0	1	1	0	1	0	0	064
5	0	1	1	0	1	0	1	065
6	0	1	1	0	1	1	0	066
7	0	1	1	0	1	1	1	067
8	0	1	1	1	0	0	0	070
9	0	1	1	1	0	0	1	071
SP	0	1	0	0	0	0	0	040
!	0	1	0	0	0	0	1	041
"	0	1	0	0	0	1	0	042
#	0	1	0	0	0	1	1	043
$	0	1	0	0	1	0	0	044
%	0	1	0	0	1	0	1	045
&	0	1	0	0	1	1	0	046
'	0	1	0	0	1	1	1	047
(	0	1	0	1	0	0	0	050
)	0	1	0	1	0	0	1	051
*	0	1	0	1	0	1	0	052
+	0	1	0	1	0	1	1	053
,	0	1	0	1	1	0	0	054
–	0	1	0	1	1	0	1	055

Table 2-2. ASCII CODE

CHAR.	ADB NO. 7	6	5	4	3	2	1	OCTAL EQUIV.
.	0	1	0	1	1	1	0	056
/	0	1	0	1	1	1	1	057
:	0	1	1	1	0	1	0	072
;	0	1	1	1	0	1	1	073
<	0	1	1	1	1	0	0	074
=	0	1	1	1	1	0	1	075
>	0	1	1	1	1	1	0	076
?	0	1	1	1	1	1	1	077
NULL	0	0	0	0	0	0	0	000
H-TAB	0	0	0	1	0	0	1	011
LF	0	0	0	1	0	1	0	012
V-TAB	0	0	0	1	0	1	1	013
FORM	0	0	0	1	1	0	0	014
CR	0	0	0	1	1	0	1	015
X-ON	0	0	1	0	0	0	1	021
X-OFF	0	0	1	0	0	1	1	023
	1	0	1	1	1	1	0	136
←	1	0	1	1	1	1	1	137

2-33. Use the following procedure to program the 6010A, using fixed form entry for an output of: 0 dB Attenuation, 10.23456 MHz Output Frequency, FM OFF, AM ON, HIGH Range ON and Remote Level OFF.

a. Enter I to address attenuator position then 0 to enter 0 dB of attenuation.

b. Enter A to address MSD position then 1.
Enter B to address 2SD position then 0.
Enter C to address 2SD position then 2.
Enter D to address 4SD position then 3.
Enter E to address 5SD position then 4.
Enter F to address 6SD position then 5.
Enter G to address LSD position then 6.

NOTE

The position of the decimal point, between the 0 and 2, is fixed when the high range is selected.

c. Enter H to address FM, AM, RANGE, REMOTE LEVEL, and UPDATE, then enter 6 to program FM-OFF, AM-ON, RANGE-HIGH, REMOTE LEVEL-OFF, and UPDATE the synthesizer latches.

Table 2-3. REMOTE CONTROL CONNECTIONS

PIN NO.	DATA NAME	DATA DESCRIPTION
1	A D B 1	
2	A D B 2	Four of seven ASCII Data Bit input lines (High True)
3	A D B 3	
4	A D B 4	
5	POWER ON	+5 volt indicates 6010A power is on
6	DRY	Data Ready: Positive edge trigger indication, from the remote programmer, that the input data is ready for transfer.
7	BSY	Busy indication: High true indication that the 6010A is busy reading the input data. *NOTE* *The input data to the 6010A must be held constant until the BSY line goes low.*
8	SPARE	
9	$\overline{\text{REMS}}$	Remote control order: Low input to order 6010A remote operation
10	SPARE	
11	ROL	Reduce Output Level: High true indication that the 6010A is being programmed to produce an output in excess of 5V rms.
12	SPARE	
13	A D B 5	
14	A D B 6	Three of seven ASCII Data Bit input lines.
15	A D B 7	
16	SPARE	
17	SPARE	
18	SPARE	
19	RC FORMAT	Remote Control Format: Fixed form remote control is called when pin 19 is open or high. Free form remote control is called when pin 19 is pulled low.
20	SPARE	
21	SPARE	
22	SPARE	
23	SPARE	
24	GND	Ground: Provides a connection to 6010A logic common.

Table 2-4. FIXED FORM REMOTE PROGRAM

ADDRESS CHARACTER	ADDRESSED POSITION	POSITION INPUT DATA
A	MSD (DELAYED UPDATE)	DIGIT, 0 or 1
B	2SD (DELAYED UPDATE)	DIGIT, 0 - 9
C	3SD (DELAYED UPDATE)	DIGIT, 0 - 9
D	4SD (DELAYED UPDATE)	DIGIT, 0 - 9
E	5SD (DELAYED UPDATE)	DIGIT, 0 - 9
F	6SD (DELAYED UPDATE)	DIGIT, 0 - 9
G	LSD (DELAYED UPDATE)	DIGIT, 0 - 9
H	FM, AM, RANGE, REMOTE LEVEL, and UPDATE	See table below
I	40dB ATTEN, 20dB ATTEN, and UPDATE	See table below
Q	MSD (IMMEDIATE UPDATE)	DIGIT, 0 or 1
R	2SD (IMMEDIATE UPDATE)	DIGIT, 0-9
S	3SD (IMMEDIATE UPDATE)	DIGIT, 0-9
T	4SD (IMMEDIATE UPDATE)	DIGIT, 0-9
U	5SD (IMMEDIATE UPDATE)	DIGIT, 0-9
V	6SD (IMMEDIATE UPDATE)	DIGIT, 0-9
W	LSD (IMMEDIATE UPDATE)	DIGIT, 0-9
(comma)	UPDATE	UPDATES SYNTHESIZER LATCHES

ASCII CHAR.	FM	AM	RANGE	REMOTE LEVEL
0	OFF	OFF	LOW	OFF
1			LOW	ON
2			HIGH	OFF
3		OFF	HIGH	ON
4		ON	LOW	OFF
5			LOW	ON
6			HIGH	OFF
7	OFF	ON	HIGH	ON
8	ON	OFF	LOW	OFF
9			LOW	ON
:			HIGH	OFF
;		OFF	HIGH	ON
<		ON	LOW	OFF
=			LOW	ON
>			HIGH	OFF
?	ON	ON	HIGH	ON

ASCII CHAR.	IGNORE	IGNORE	40dB	20dB
0	–	–	OUT	OUT
1	–	–	OUT	IN
2	–	–	IN	OUT
3	–	–	IN	IN

NOTE

When using fixed form remote programming, characters Q, R, S, T, U, V and W provide frequency edit capability. Entry of one of these characters followed by the appropriate digit will result in an immediate update of the synthesizer latches. Refer to Table 2-4.

2-34. FREE FORM REMOTE INPUTS

2-35. The free form of remote data input, presented in Table 2-5, provides freedom of data entry equal to that of the front panel keyboard and edit controls. The ASCII characters have been selected to represent the function of a key or control (FREQUENCY EDIT) on the front panel. Note that some of the functions, in addition to the function character require a numeric entry to indicate the state of the function. Refer to Table 2-2 for the seven bit word for each character used.

2-36. Use the following procedure to program the 6010A, using free form entry, for an output of: 0.5 - 5V Output Level Band, 10.23456 MHz Output Frequency, FM OFF, AM ON and Remote Level OFF.

NOTE

If the last data entered is not known, program C to clear all data.

a. Enter O then 3 for 0.5 - 5V Output Level Band.

b. Enter 1, 0, DECIMAL, 2, 3, 4, 5, 6, and M for 10.23456 MHz.

c. Enter F then 0 for FM Off.

d. Enter A then 1 for AM On.

e. High range will be automatically selected when the programmed frequency is over 109.9999 kHz.

f. Enter E then 0 for Remote Level Off.

Table 2-5. FREE FORM REMOTE INPUTS

ASCII CHAR.	FUNCTION	NOTES
A<N>	AM	N [0 = AM OFF, 1 = AM ON]
B<N>	SELECT EDIT DECADE	N [0 = LSD thru 7 = MSD]
C	CLEAR	Clear all functions and display
D	DECREMENT EDIT DECADE	Decreases edit decade digit one number for each entry.
E<N>	REMOTE LEVEL	N [0 = REMOTE LEVEL OFF, 1 = ON]
F<N>	FM	N [0 = FM OFF, 1 = FM ON]
G	NOT USED	
H	Hz	Select Hz output units
I	INCREMENT EDIT DECADE	Increases edit decade digit one number for each entry.
J	NOT USED	
K	kHz	Selects kHz output units
L	LOW RANGE	Range override to low range
M	MHz	Selects MHz output units
N	NOT USED	
O<N>	OUTPUT LEVEL BAND	N [0=0.5-5 mV, 1=5-50 mV, 2=50-500 mV, 3=0.5-5V]
P	NOT USED	
Q	NOT USED	
R<N>	RECALL	N [0 = Location 0 thru 9= Location 9]
S<N>	STORE	N [0 = Location 0 thru 9 = Location 9]
T	NOT USED	
U	HIGH RANGE	Range override to high range
0 - 9	DIGITS 0 - 9	Selects digits 0 - 9 to enter frequencies or set the state of the remote programmed function.
· (Decimal)	DECIMAL	Enters decimal point for selected output frequencies.

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains the theory of operation for the Model 6010A Synthesized Signal Generator. The theory is presented at a block diagram level; referring to the block diagram in Figure 3-1, sheets 1 and 2. The fundamental operation of each block as well as the functional relationships of the blocks will be discussed. All information concerning options will be found in Section 6 of this manual.

3-3. BLOCK DIAGRAM ANALYSIS

3-4. Input Output Module (6010A-4101) (See Figure 3-1, Sheet 1 of 2)

3-5. The Input Output Module contains the 10 MHz crystal controlled oscillator from which the generator developes the 10 Hz to 11 MHz output. A level detector is used to disable the internal oscillator when an external reference source is applied to the rear panel EXT REF input jack. The 10 MHz reference signal is applied, via J3, to the Main pcb to be used as a timing signal and to provide the rear panel REF OUT signal. The 10 MHz reference is also applied to a ten-to-one (10/1) divider to create a 1 MHz signal for the 6 Digit Generator Module. Within the Input Output Module the 10 MHz reference signal is applied to a 50/1 divider and a times-two (x2) frequency multiplier.

3-6. The 0.2 MHz output of the 50/1 divider is selected in low range and the 20 MHz output of the x2 multiplier selected in high range as an input to the level control amplifier. The level control input signal to the amplifier comes from the Display pcb and is determined by the front panel OUTPUT LEVEL control or the signal applied to the rear panel AM IN jack. The output signal from the level control amplifier is the lower frequency of the two inputs applied to the mixer. The other input to the mixer, when operating in high range, is a 20-31 MHz signal from the 6-Digit Generator Module. When the low range is selected, the 100/1 divider reduces the signal frequency to 0.2 - 0.31 MHz. A Low Pass Filter (LPF) on the output of the mixer allows only the difference frequency (10 Hz to 11 MHz) to pass when in high range. In low range an additional filter is added to the output to pass a lower difference frequency of 10 Hz to 110 kHz. An output amplifier insures that the output signal going to the Attenuator Module is up to five volts rms, depending on the setting of the Front Panel Output Level Vernier.

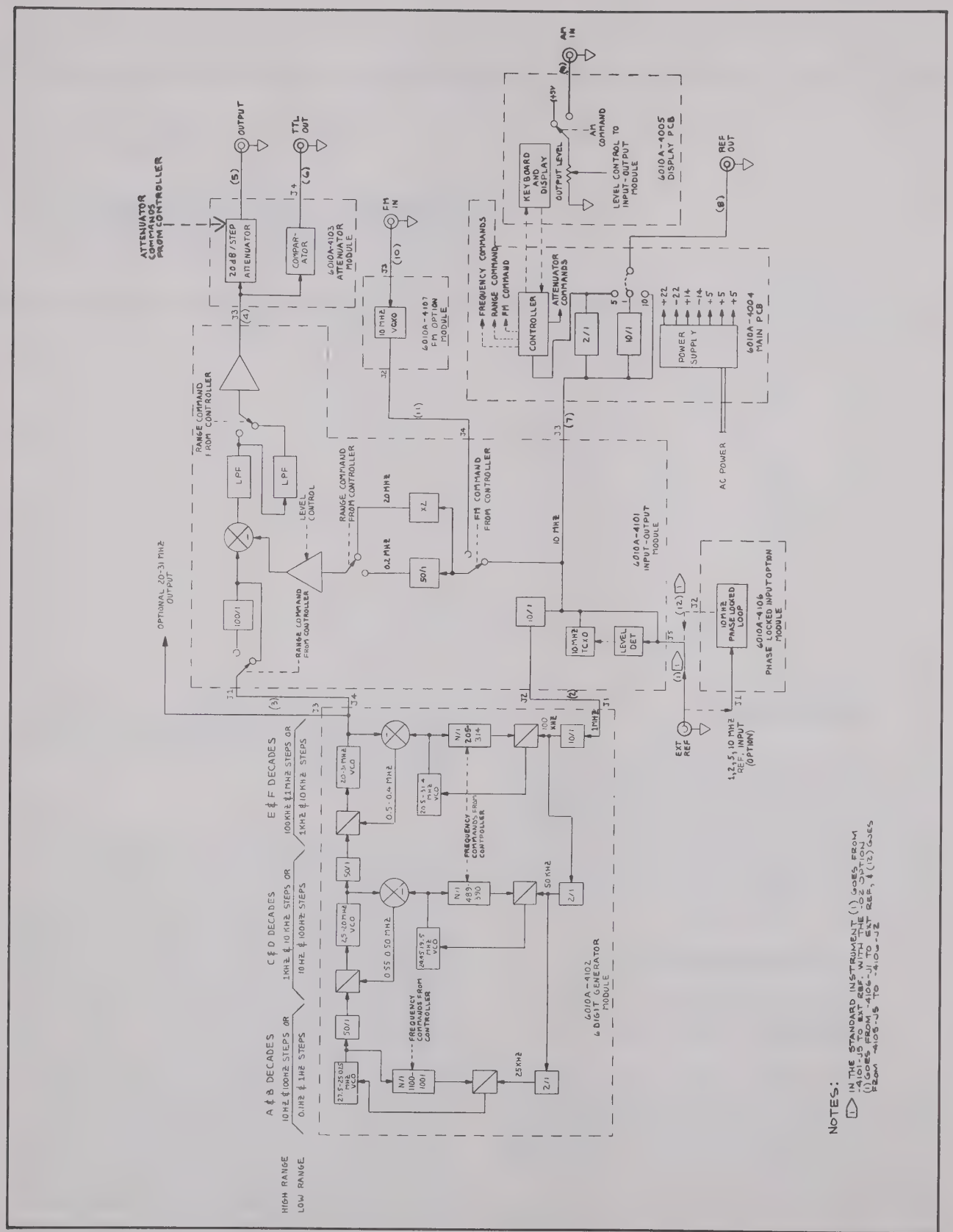


Figure 3-1. BLOCK DIAGRAM (Sheet 1 of 2)

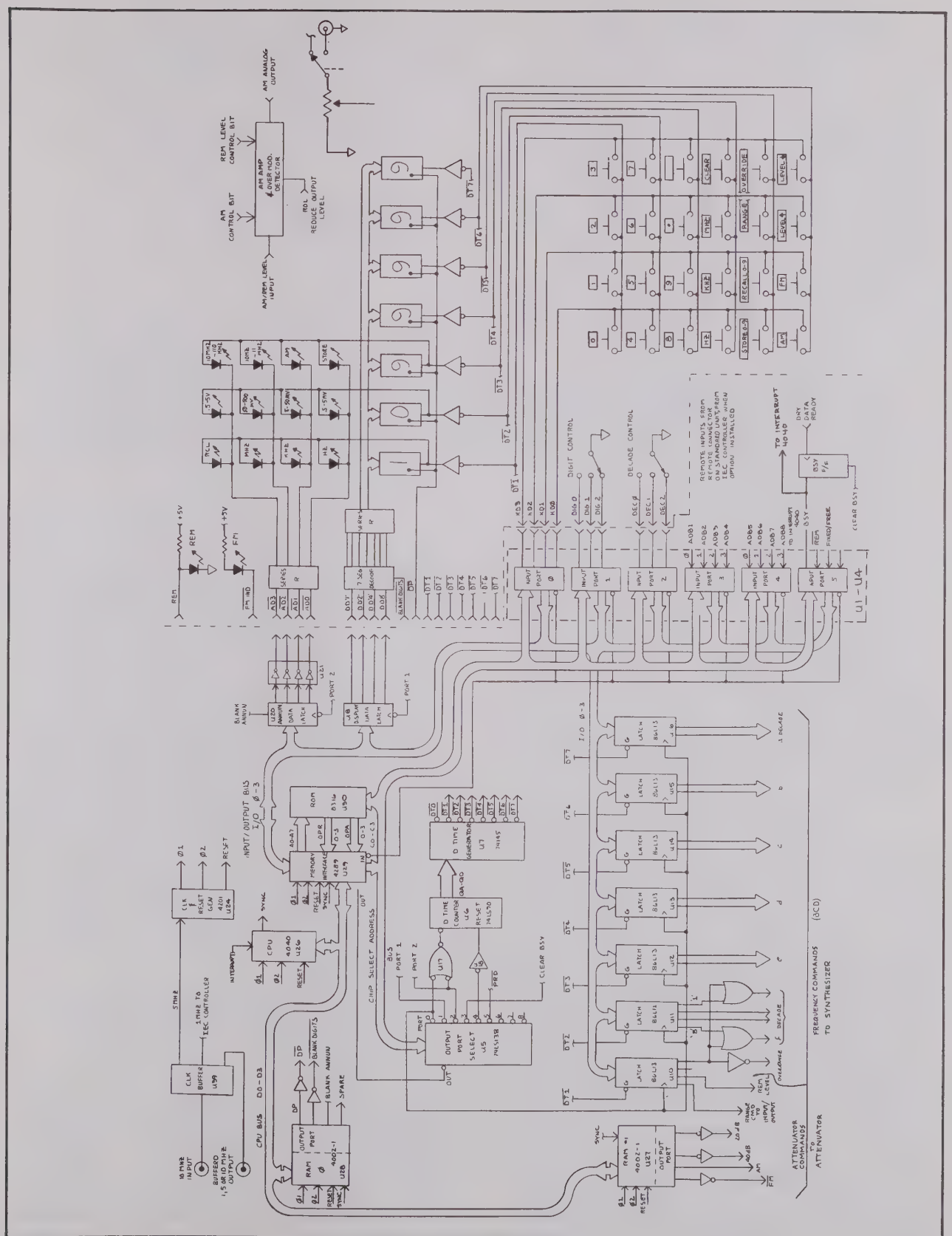


Figure 3-1. BLOCK DIAGRAM (Sheet 2 of 2)

3-7. 6-Digit Generator Module (6010A-4102) (See Figure 3-1, Sheet 1 and 2)

3-8. The 1 MHz input signal to the 6-Digit Generator is applied to a ten-to-one divider producing a 100 kHz phase control signal for the E and F decade step loop. The 100 kHz signal is divided by two to provide a 50 kHz phase control signal for the C and D decades, then divided by two again to produce the 25 kHz phase control signal for the A and B decades. The 25, 50, and 100 kHz signals are applied to phase detectors in the A and B, C and D, and E and F decade step loops respectively. Each step loop comprises a Voltage Controlled Oscillator (VCO), an N/1 divider, and a phase detector. Because the operation of all three step loops is basically the same only the A and B decade loop will be discussed.

3-9. Frequency control commands, generated by the front panel keyboard or remote control inputs, determine the division ratio so that the output of the N/1 divider is maintained at 25 kHz. For example: when the frequency control commands establish an 1100/1 division ratio, the output of the VCO (27.5 MHz) is divided by 1100, the resulting frequency is 25 kHz. If the frequency commands change the division ratio to 1050/1 the 27.5 MHz VCO frequency will cause the output of the divider to be greater than 25 kHz. The phase detector produces a control voltage output to the VCO, whenever the N/1 divider output is not exactly 25 kHz. The new division ratio (1050/1) will cause the VCO output frequency to change from 27.5 MHz to 26.26 MHz. The step loop operation of the C and D decades and the E and F decades is the same as that of the A and B decades. The division ratios of the dividers and the frequency outputs of the VCO change but the basic operation is the same.

3-10. Two main loops, one for the C and D decade and one for the E and F decade, are used to combine the output of the decades' step loop with the frequency output from the preceding decade. The output frequency of decades A and B is divided by the 50/1 divider to provide one input signal to the phase detector at a frequency between 0.55 and 0.50 MHz. The other input to the phase detector is obtained by mixing the 25-20 MHz VCO frequency with the output of the C and D step loop. The difference frequency produced by this mixing is then input to the phase detector. If these two signals are not equal, the phase detector will cause the 25-20 MHz VCO frequency to be altered until they are equal. The 25-20 MHz output of the C and D decades main loop VCO is divided by a 50/1 divider and applied to the phase detector in the E and F decades main loop. A second input to this phase detector is the difference frequency produced by mixing the 20-31 MHz VCO frequency with the output of the E and F decades step loop. The phase detector output will provide control for the 20-31 MHz VCO. In this manner any change in the A and B decades output frequency causes a change in the C and D decades main loop frequency which then causes a change in the E and F decades main loop frequency. The final result being that the output of the 20-31 MHz VCO is a frequency resulting from the combined outputs of the three step loops. The output of the 6-Digit Generator Module is connected to the Input-Output Module.

3-11. Main PCB (6010A-4004) and Display PCB (6010A-4005) (See Figure 3-1, Sheets 1 and 2)

3-12. The Main pcb contains the power supplies, a divider network for selecting the REF OUT frequency, and the controller (microprocessor). The Display pcb contains the level controls, keyboard for data entry, and the display. The power supply on the Main pcb provides operating and logic power for the entire instrument. (Three +5 volt supplies are used because of the total +5 volt power requirement and to eliminate the possible interference between logic circuitry.)

3-13. The 10 MHz reference signal from the Input-Output Module is applied to 2/1 and 10/1 dividers to provide the selectable REF OUT signals of 5 MHz or 1 MHz. The 5 MHz reference output signal also is used as a clock input to the Clock Generator, U24. This circuit produces the Reset signal at Power On and the two-phase clock signal necessary to drive the Controller. Instructions for the Controller are obtained from the software ROM, U30, as a result of data being entered from the Front Panel keyboard or a Remote Input device. As these instructions are executed, each Input port is sampled for data. Any data present will be placed in the temporary storage within the Controller. From here, the data will be supplied to the appropriate Output port in accordance with the instructions received by the Controller. This data is in the form of frequency commands to the 6-Digit Generator Module, range commands to the Input-Output Module, attentuator commands to the Attenuator Module, and selects Frequency Modulation (FM) when the FM Option Module is installed.

3-14. Attenuator Module (6010A-4103) (See Figure 3-1, Sheet 1 of 2)

3-15. The Attenuator Module comprises a 20 dB per step attenuator and a comparator. The front panel keyboard, via the controller, selects an attenuation level for the output signal of 0, 20, 40, or 60 dB. The comparator produces a TTL compatible square wave output from the 10 Hz to 10 MHz signal input from the Input-Output Module. The TTL OUT connector will provide the correct TTL output level irregardless of the output level or attenuator settings.

Section 4
Maintenance

WARNING!

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual contains information and instructions concerning the service, maintenance access, operational evaluation, and calibration of the Model 6010A Synthesized Signal Generator. A list of recommended test equipment for instrument evaluation is provided in Table 4-1.

Table 4-1. REQUIRED TEST EQUIPMENT

EQUIPMENT NOMENCLATURE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Frequency Counter	0.1 Hz Resolution and External Time-base Input	Fluke Model 1953A with –10 Option
Oscilloscope	100 MHz Band-width	Tektronix Model 7613
Plug-in	0.5 mV/cm Sensitivity	Tektronix 7A15AN Plug-in Amplifier
Signal Generator	10 kHz Output at 0.25V peak to 5V peak	Wavetek Model 130
50 ohm load	50 ohm feed through termination	Tektronix Part No. 011-0049-01
RMS Voltmeter	±0.05% Accuracy 2 Hz - 2 MHz Band	Fluke Model 931B
Spectrum Analyzer	-128 dBm Sensitivity 30 Hz Resolution	Tektronix 7L13 Plug-in
Frequency Mixer		RELCOM M-1

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Mfg. Co., Inc. is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is located at the front of the manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various worldwide locations. A complete list of the authorized service centers is located in Section 7 of this manual. Shipping information is presented in Section 2. If requested, an estimate of repair costs will be provided the customer before any repair work is begun on instruments that are beyond the warranty period.

4-6. MAINTENANCE ACCESS

4-7. To gain access to the major sections of the signal generator, proceed as follows:

a. Turn off the signal generator and disconnect the power cord.

b. Remove the top and bottom dust covers. This will expose the INPUT/OUTPUT module (as viewed from the top) and the SIX-DIGIT GENERATOR module (as viewed from the bottom).

c. Remove the six screws (three each side) securing the INPUT/OUTPUT module in place.

NOTE

There are four screws on each side of the module; remove the front three. The rear screws is a pivot screw that allows the module to be swung away for access to interior module(s); loosen it slightly.

d. Lift the front of the INPUT/OUTPUT module; swing it up and back until it comes to rest against the stop. This provides access to the ATTENUATOR module and the MAIN PCB.

e. The SIX-DIGIT GENERATOR module can be swung away to provide access to the bottom of the MAIN PCB. Remove the six screws (three front screws on each side) securing the module in place; loosen the rear two pivot screws. Swing the module back to expose the bottom of the MAIN PCB.

f. The Reference Output can be altered as follows. With the INPUT/OUTPUT module swung back, remove the four screws which hold the ATTENUATOR module (4103). Carefully lift this module to expose the top side of the MAIN PCB. Viewing from the front of the instrument, the Reference Output jumper network is on the left edge center of the board. Remove the jumper from the 1 MHz point and connect to the desired point.

4-8. GENERAL MAINTENANCE

4-9. Cleaning

4-10. Clean the instrument periodically to remove dust, grease, and other contamination. Use the following procedure:

a. Clean the interior with clean, dry air at low pressure. When printed circuit boards require cleaning, first spray them with Freon T.F. Degreaser (Miller Stepensen Company, Inc.) and then remove the dirt with clean, dry air at low pressure.

b. Clean the front panel and exterior surfaces with anhydrous ethyl alcohol or a soft cloth dampened in a mild solution of detergent and water.

4-11. Fuse Replacement

4-12. The line power fuse is located in a fuse holder mounted on the rear panel of the instrument. This fuse provides protection for the power supply circuitry. Replace an open fuse with a 1A Slo-Blo fuse (115V operation), or a ½A Slo-Blo fuse (230V operation).

4-13. PERFORMANCE CHECKS

4-14. The following procedures compare the 6010A performance with the specifications listed in Section 1. These procedures are suited for performance evaluation upon receipt of a new instrument, periodic maintenance checks and performance evaluation after repairs. A Performance Check Record Card is provided at the end of this section for recording the performance of the instrument. Should the instrument fail to meet any performance requirement, perform the adjustment procedures provided in the calibration material. During the following performance checks the input line voltage should be varied ±10% at some point in each check to insure that the instrument will perform at various ac line voltages.

4-15. Frequency Accuracy

4-16. The following procedure evaluates the accuracy of the output frequency at the front panel output connector. This procedure is for the standard 6010A instrument. Refer to Section 6 for the performance test for instruments equipped with the High Performance TCXO Option —01.

a. Connect the frequency counter, terminated in 50 ohms, to the 6010A front panel output connector.

b. Rotate the 6010A OUTPUT LEVEL control fully clockwise.

c. Set the 6010A LEVEL to the 50 - 500 mV band.

d. Select the output frequencies listed in Table 4-2 and observe the counter for a corresponding reading within the limits specified.

Table 4-2. OUTPUT FREQUENCY ACCURACY

6010A SELECTED FREQUENCY	COUNTER DISPLAY
100 kHz	99,999.7 to 100,00.3 Hz
1 MHz	999,997 to 1,000,003 Hz
5 MHz	4,999,985 to 5,000,015 Hz
10 MHz	9,999,970 to 10,000,030 Hz

4-17. Harmonic Distortion

4-18. The following procedure will determine if the 6010A meets the harmonic distortion specifications as stated in Section 1. The specifications divide the harmonic tolerance limits into two frequency ranges. Harmonics of frequencies from 10 Hz to 1 MHz must be 50 dB below the fundamental and harmonics of 1 MHz to 11 MHz signals must be 40 dB below the fundamental.

a. Connect the equipment as shown in Figure 4-1. (7613 oscilloscope must be equipped with the 7L13 Spectrum Analyzer Plug-in module.)

b. Select the 50 - 500 mV LEVEL band on the 6010A at a 10 MHz output frequency.

c. Set the 6010A OUTPUT LEVEL control to +20 dBm.

d. Adjust the spectrum analyzer so that the fundamental and up to five harmonics can be observed.

NOTE

Over-driving the rf amplifier on the spectrum analyzer may cause incorrect indication of harmonic levels. Insure that the input signal amplitude is less than the maximum input amplitude setting of the rf amplifier.

e. The amplitude of the harmonics must be at least 50 dB less than that of the fundamental.

f. Select the following 6010A output frequencies and observe the harmonics levels to be at least 50 dB below the fundamental; 10 kHz, 100 kHz, 500 kHz, and 1 MHz.

g. For the following output frequencies the harmonics must be at least 40 dB below the fundamental frequency amplitude; 2 MHz, 5 MHz, 8 MHz, and 10.5 MHz.

h. Select the 0.5 - 5V LEVEL band and rotate the OUTPUT LEVEL control fully clockwise.

i. The harmonics of the 10.5 MHz output signal must be more than 35 dB below the fundamental.

4-19. Spurious

4-20. The following procedure will evaluate the 6010A spurious signal levels. The specifications for spurious signal level states that all non-harmonically related outputs will be greater than 60 dB below the specified output of –110 dBm whichever is greater (–110 dBm being the lower limit). A spectrum analyzer is used to observe the level of the spurious signals.

a. Connect the spectrum analyzer to the 6010A OUTPUT connector.

b. Select a 6010A output frequency of 100 kHz at an output level of 0 dBm.

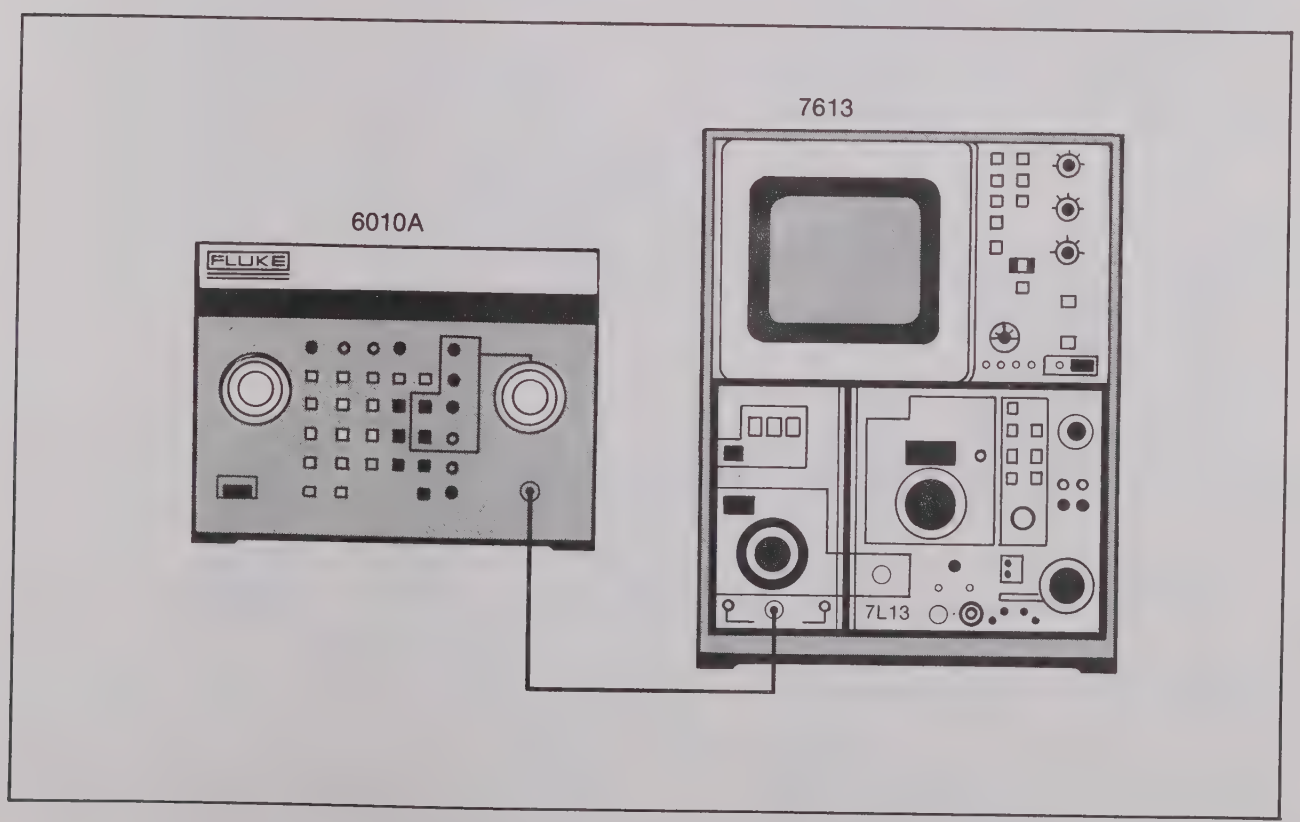


Figure 4-1. HARMONIC DISTORTION TEST EQUIPMENT SET-UP

c. Set the spectrum analyzer FREQ SPAN/DIV to 50 kHz CENTER FREQUENCY to 100 kHz.

d. Adjust the RF IN control on the spectrum analyzer so the 100 kHz fundamental 6010A signal amplitude is 0 dBm.

e. Observe the spectrum analyzer display noting that the spurious signals are at least 60 dB below the amplitude of the 100 kHz fundamental signal.

f. Select the 6010A output frequencies indicated in Table 4-3 and observe the spurious signals to be more than 60 dB below the fundamental signal level.

g. Decrease the 6010A output level to –40 dBm and select the output frequencies in Table 4-3.

Table 4-3. SPURIOUS OUTPUT

6010A OUTPUT FREQUENCY	RANGE	NOTES
90 kHz	LO	Look at 110 kHz spurious signal
109.9999 kHz	LO	Look at 90 kHz spurious signal
500 kHz	HI	
1 MHz	HI	
5 MHz	HI	
9 MHz	HI	Look at 11 MHz spurious signal
10.99999 MHz	HI	Look at 9 MHz spurious signal

4-21. Signal to Phase Noise Ratio

4-22. The following procedure checks the signal to residual phase noise ratio of the 6010A output. The specifications state that the residual phase noise must be more than 50 dB below the level of the fundamental frequency. This procedure applies the 6010A rear panel REF OUT signal. (See Reference Output Alternation, 4-7f, for the procedure to change from 1 to 10 MHz output, since the instrument is configured for 1 MHz at the factory.) Connect the rear panel REF OUT signal to the L input of a mixer and the 6010A synthesized front panel output to the R input. When the synthesized signal is offset sightly in frequency from the 10 MHz rear panel signal, the output of the mixer is measured as an indication of signal strength. The synthesized output signal is then set to 10 MHz so that the difference output of the mixer represents only the noise generated by the 6010A synthesis process.

4-23. The level of the signal (the difference between the 10 MHz REF OUT signal mixed with the 10 MHz offset synthesized front panel output) is set for a full scale indication on the 931B. The offset frequency is then removed and the 6010A output level increased by 40 dB so that the 931B, on the same range, will indicate that the noise output is 50 dB less than the signal output.

NOTE

The 7613 oscilloscope must be equipped with the 7A14AN Plug-in Amplifier for this test, to provide sufficient amplitude to drive the 931B.

a. Connect the test equipment as shown in Figure 4-2 and allow the equipment normal warm-up time.

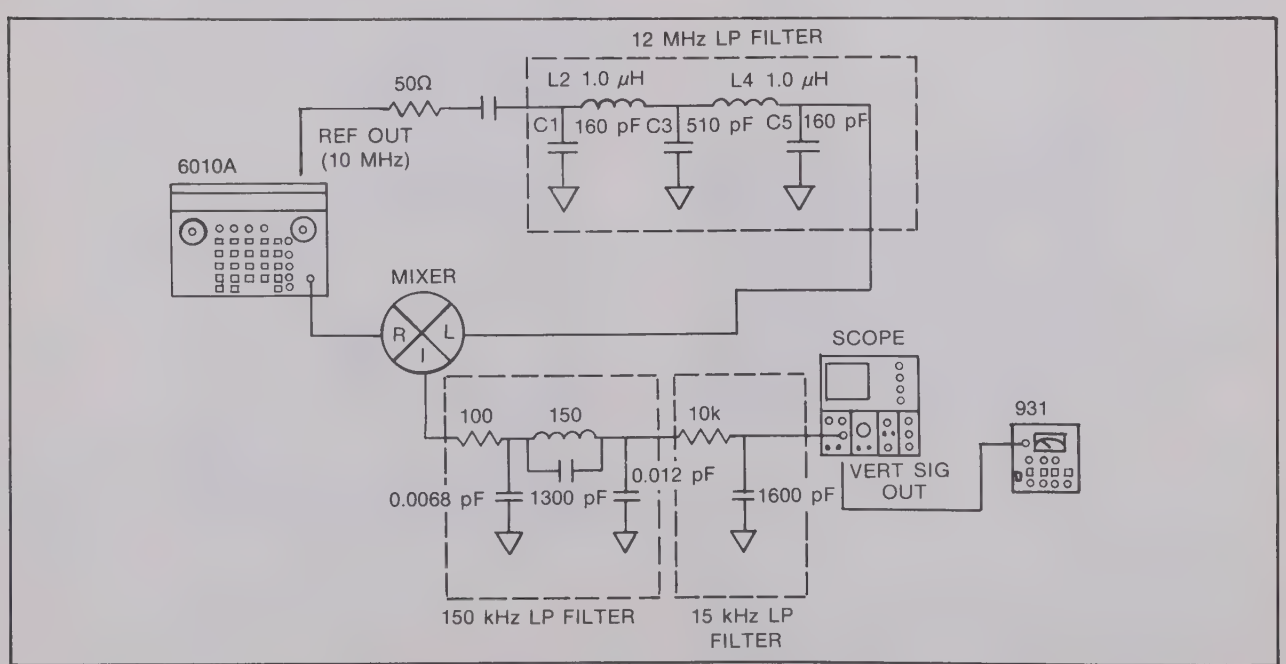


Figure 4-2. SIGNAL TO RESIDUAL PHASE NOISE TEST SET-UP

CAUTION

Do not allow the output of the 6010A to exceed +10 dBm.

b. Select the 6010A output of 10 MHz and the –60 dB LEVEL band.

c. Set the oscilloscope VOLT/DIV control to 10 mV.

d. Use the FREQUENCY EDIT, DECADE control to select the kHz digit then the DIGIT control the change the kHz digit to 1. (This provides a 1 kHz offset frequency.)

e. Adjust the OUTPUT LEVEL control on the 6010A for a 931B full scale reading of 100 mV.

f. Switch the 931B to the 1000 mV range.

g. Change the 6010A LEVEL to –40 dB.

h. Set the oscilloscope input coupling switch to GND and adjust the ground reference to the center horizontal line. Set the scope coupling switch to DC.

i. Note the peak-to-peak value of the scope trace.

j. Use the 6010A FREQUENCY EDIT, DIGIT control to switch the kHz digit to 0. The scope will indicate some dc value. Change the kHz digit from 0 to 1 then back to 0 until the dc value on the scope (when kHz digit is 0) is less than one third of the peak value of the scope trace when the kHz digit is 1.

k. Change the 6010A LEVEL to –20 dB.

l. Switch the 931B to the 100 mV range. The 931B meter reading should be less than 0.45. Any indication less than the 0.45 reading indicates that the noise is at least 50 dB below the signal level.

4-24. CALIBRATION

4-25. The calibration procedures described below are intended to provide the checks and adjustments necessary to maintain proper instrument operation. These procedures should be performed whenever the instrument fails to meet the requirements of the performance checks or whenever repairs are completed on the 6010A circuitry. The specifications for the required test equipment are presented in Table 4-1.

4-26. The following procedures provide for the calibration of each module separately. This allows a module to be repaired and recalibrated without affecting the rest of the unit. In some cases the module calibration procedure is further broken down into subheadings which indicate the particular parameter of module operation the adjustment is for. This information may be useful in troubleshooting the unit.

4-27. Main PCB Adjustments

4-28. Adjustments to the Main PCB circuitry are limited to two power supplies. The plus and minus fourteen volt supplies are required to be adjusted to within 0.05 volts. Adjust these supplies as follows:

a. Remove the 6010A top cover and swing the Input/Output module out.

b. Connect the voltmeter LO input lead to the rear lead of either C8 or C17. (Large capacitors on the left side of the Main PCB.)

c. Connect the voltmeter HI input lead to J5 pin 1.

d. Adjust R14 for a voltmeter indication of –14 ±0.05V dc.

e. Connect the voltmeter HI input lead to J5 pin 2.

f. Adjust R6 for a voltmeter indication of +14 ±0.05V dc. ALSO CHECK 3 SEPARATE 5 VOLD SUPPLIES (MC 7805)

4-29. Input/Output Module Adjustments

4-30. 10 MHz OSCILLATOR ADJUSTMENT

4-31. The 10 MHz internal frequency standard may be adjusted through an access hole in the top cover of the module. Adjust the oscillator as follows:

NOTE

Allow at least 30 minutes warm-up before this adjustment is made.

a. Remove the 6010A top cover and swing out the Input/Output module.

b. Unplug the cable from connector J3 on the Input/Output module.

c. Connect a frequency counter to connector J3.

d. Adjust the oscillator for a frequency counter indication of 10 MHz ±1 Hz.

4-32. TANK CIRCUIT TUNING

4-33. Three adjustments must be made to tune the circuit to the proper resonant frequency. Adjustments to these circuits should not be necessary unless repair work has been done in the immediate area. Adjust the tank circuits as follows:

a. Connect the spectrum analyzer input, via an FET probe, to TP5.

b. Adjust L14 for a maximum 20 MHz signal.

c. Apply –5 volts dc to the AM IN connector on the 6010A rear panel.

d. Short TP7 to TP2 on the Input/Output module.

e. Connect the specrum analyzer input, via an FET probe, to TP6.

f. Adjust L15 for a minimum 20 MHz indication on the spectrum analyzer.

g. Remove the short between TP7 and TP2.

h. Adjust L16 for a maximum 20 MHz indication on the spectrum analyzer.

i. Repeat steps d through h, until there is no more interaction between L15 and L16 adjustments.

j. Remove the –5 volts dc from the AM IN connector.

4-34. OUTPUT LEVEL ADJUST

4-35. This procedure is for the coarse adjustment of the Input/Output module output level. If major repairs have been completed on this board this procedure should be done. The Frequency Response Test later in this section will fine tune the output level. Make the coarse adjustment to the output level as follows:

a. Connect the oscilloscope, terminated in 50 ohms, to the 6010A front panel OUTPUT connector.

b. Select a 6010A 1 MHz output frequency at 5V rms output level.

c. Adjust R92 on the Input/Output module for a 15 volt peak-to-peak signal on the oscilloscope.

d. Select a 6010A 1 kHz output frequency (LO band) at 5V rms output level.

e. Adjust R126 on the Input/Output module for a 15 volt peak-to-peak signal on the oscilloscope.

4-36. HIGH FREQUENCY ROLL-OFF ADJUST

4-37. The output level of the 6010A rolls-off at high frequencies. This procedure will adjust the compensating circuit to maintain the output level within the specifications at high output frequencies. Adjust the High Frequency Roll-Off as follows:

a. Connect the spectrum analyzer to the OUTPUT connector on the front panel of the 6010A.

b. Select a 6010A output frequency of 10.175 MHz at an output level of 5V rms (+27 dBm).

c. Adjust the spectrum analyzer to a center frequency of 20.350 MHz.

d. Select a 6010A output of 350 kHz.

e. Rotate the 6010A OUTPUT LEVEL control fully counterclockwise.

f. Decrease the spectrum analyzer input attentuation by 30 dB.

g. Adjust L32 on the Input/Output module counterclockwise until the 20.350 MHz spectrum analyzer signal increases, then turn L32 clockwise until the signal just reaches minimum.

h. Disconnect the spectrum analyzer.

4-38. DC LEVEL ADJUST

4-39. This procedure adjusts the dc voltage bias of the Input/Output option 10 Hz to 11 MHz output signal. Adjust the DC Level as follows:

a. Ground the AM IN connector on the 6010A rear panel.

b. Connect a dc-coupled oscilloscope to R84 as shown in Figure 4-3.

c. Adjust R140 for a dc level of less than 100 mV as indicated on the oscilloscope.

d. Disconnect all test equipment from the 6010A.

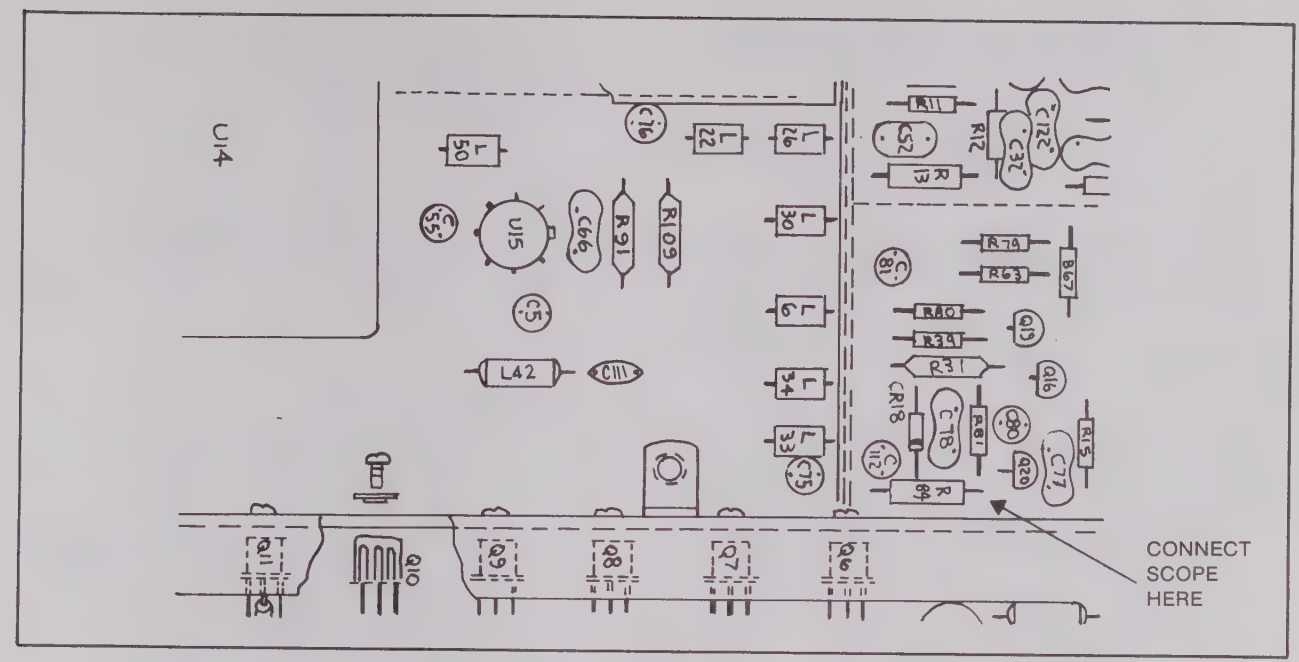


Figure 4-3. DC LEVEL ADJUST SCOPE CONNECTION

4-40. 90 kHz SPUR REDUCTION

4-41. The construction characteristics of the Input/Output module make the spur at 90 kHz, when 109.9999 kHz is selected as an output, the reference point for spur reduction. Adjust the module for the 90 kHz Spur Reduction as follows:

a. Connect a spectrum analyzer to the 6010A front panel OUTPUT connector.

b. Select a 6010A output frequency of 90 kHz at an output level of approximately 0 dBm.

c. Adjust the spectrum analyzer for a full scale display 0 dBm at 90 kHz center frequency.

d. Change the 6010A output frequency to 109.9999 kHz.

e. Adjust R77 to minimize the 90 kHz spur. Spur must be greater than 70 dB below the 90 kHz reference point set in step b.

4-42. HARMONIC MINIMIZATION

4-43. A balance adjustment is provided in the Input/Output module final amplifier to minimize the level of harmonic output. Adjust the harmonic output level as follows:

a. Select a 6010A output frequency of 10.99999 MHz at an output level of +27 dBm.

b. Connect the spectrum analyzer to the 6010A OUTPUT connector on the front panel.

c. Observe the second through fourth harmonics on the spectrum analyzer and adjust R46 to minimize their level.

NOTE

All harmonics should be at least 38 dB below the fundamental.

d. Disconnect all test equipment.

4-44. DC BALANCE ADJUST

4-45. The purpose of this procedure is to equalize the dc voltage bias of the high and low frequency ranges. Make the DC Balance Adjust as follows:

a. Ground the AM IN connector on the 6010A rear panel.

b. Connect a dc coupled oscilloscope to the 6010A front panel OUTPUT connector.

c. Select a 6010A output of 1 MHz.

d. Adjust R16 for an oscilloscope presentation of 0 volts ±10 mV. Note the level.

e. Select a 6010A output frequency of 100 Hz.

f. Adjust R142 for the same dc voltage indication on the oscilloscope that was noted in step d.

g. Disconnect all test equipment from the 6010A.

4-46. FREQUENCY RESPONSE ADJUST

4-47. The frequency response adjustment checks the output level of the 6010A at selected frequencies in both the high and low bands to insure that the output amplitude versus frequency meets the specification requirements listed in Section 1. Adjust the Frequency Response as follows:

a. Select a 6010A output frequency of 10 kHz and press the HI — RANGE OVERRIDE key. Select the 0.5 - 5V LEVEL band and rotate the OUTPUT LEVEL control fully clockwise.

b. Connect a 931B rms voltmeter to the 6010A front panel OUTPUT connector.

c. Adjust R92 for a voltmeter indication of 5.20 volts.

d. Press the LO RANGE OVERRIDE key.

e. Adjust R126 for a voltmeter indication of 5.10 volts.

f. Select the frequencies listed in Table 4-4 and observe the voltmeter for any reading outside of 5.00 ±0.20 volts.

Table 4-4. FREQUENCY RESPONSE CHECK

LO BAND	HI BAND
10 Hz	10 Hz
100 Hz	1 kHz
1 kHz	10 kHz
5 kHz	100 kHz
10 kHz	1 MHz
20 kHz	
50 kHz	
90 kHz	
100 kHz	
109.9999 kHz	

g. It may be necessary to adjust R92 (affects both HI and LO bands) and R126 (affects LO band only) to center the upper and lower extremes around 5.00 volts.

h. Disconnect all test equipment.

4-48. Six Digit Generator Adjustments

4-49. It is required that the voltmeter test leads be prepared in the manner shown in Figure 4-4. This is necessary in order to obtain the correct indications of dc voltage levels. The adjustment procedure has been broken down into subsections that describe the calibration of specific circuits.

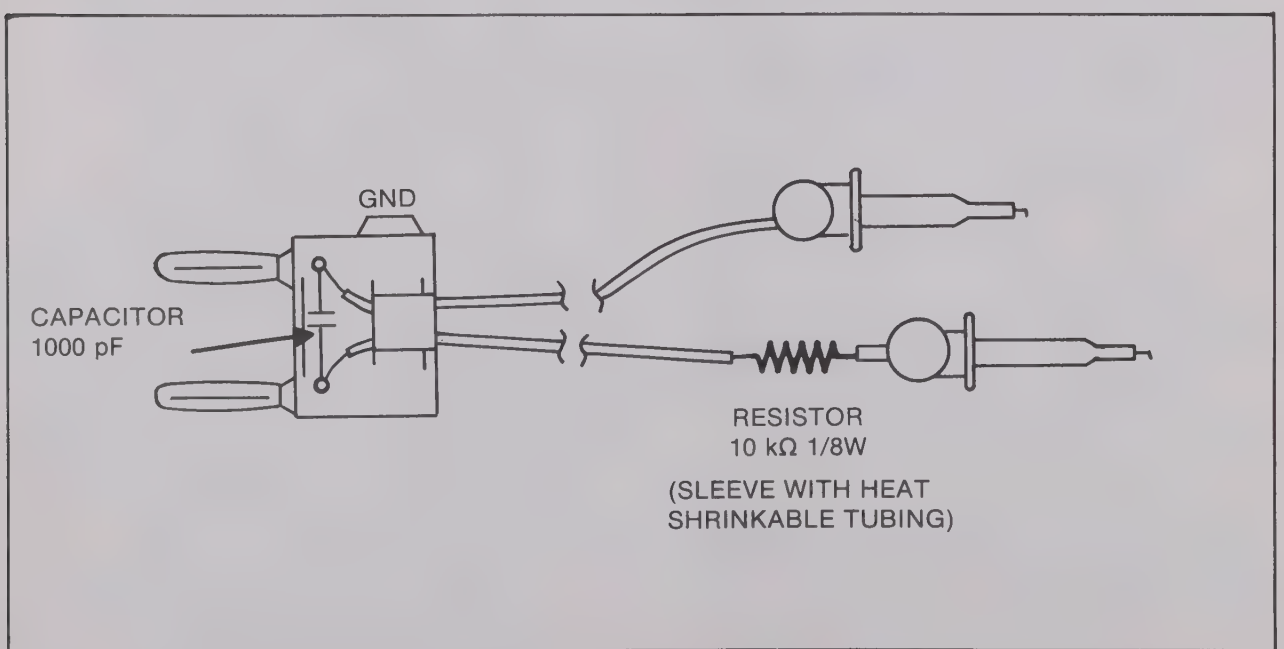


Figure 4-4. TEST LEADS FOR 6-DIGIT GENERATOR ADJUSTMENTS

4-50. STEP LOOP VCO ADJUST

4-51. The Voltage Controlled Oscillator (VCO) adjustment of each step loop affects the output frequency accuracy of the 6010A. Each step loop must be set to a particular output frequency when the associated decades are dialed to zero, so that the frequency changes caused by selecting specific decade outputs will result in the correct step loop frequency. Adjust the step loop VCOs as follows.

4-52. A and B Step Loop Adjust

a. Connect the high lead of the dc voltmeter to TP10 on the 6-digit generator pcb and the voltmeter low lead to the pcb frame.

b. Select zero output frequency from the 6010A.

c. Turn the tuning slug of T5 until the top of it is flush with the top of the case.

d. Adjust T5 clockwise for a meter indication of 3.5 ±0.1 volts.

e. Select a 9.9 Hz output frequency from the 6010A and check that the voltmeter reading is greater than 1.9 volts.

4-53. C and D Step Loop VCO Adjust

a. Connect the high voltmeter test lead to TP13 and the low lead to the pcb frame.

b. Select a 6010A output frequency of 990.0 Hz.

c. Turn the tuning slug of T4 until the top of it is flush with the top of the case.

d. Adjust T4 clockwise for a meter indication of 2.5 ±0.1 volts.

e. Select a 6010A output of 0 kHz.

f. Check the voltmeter for a display of 5.6 ±0.6 volts.

4-54. E and F Step Loop VCO Adjust

a. Connect the high voltmeter test lead to TP11 and lead to the pcb frame.

b. Turn the tuning slug of T1 until the top of it is flush with the top of the case.

c. Select a 6010A output frequency of 0 kHz.

d. Adjust T1 clockwise for a voltmeter indication of 2.5 ±0.1 volts.

e. Select a 6010A output frequency of 99.00 kHz.

f. Check the voltmeter for a display of 8.0 ±0.6 volts.

4-55. MAIN LOOP STEERING VOLTAGE ADJUST

4-56. The C and D main loop combines the output of the A and B step loop with the output of the C and D step loop. Then the E and F main loop combines the output of the C and D main loop with the output of the E and F step loop. The following procedures describe the adjustment of the main loops and checking the main loops operation with varied inputs. Adjust the main loops as follows.

4-57. C and D Main Loop Steering Voltage Adjust

a. Connect the voltmeter high input lead to TP12 and the low input lead to TP15.

b. Select a 6010A output frequency of 9.9 Hz.

c. Adjust T3 for a voltmeter indication of 0.025 ±0.025 volts.

d. Use the FREQUENCY EDIT control to vary the 100 Hz through 0.1 Hz digits, observing minimum and maximum voltmeter readings. The minimum should be 0.025 ±0.025 volts. The maximum should be greater than 0.35 volts and is likely to occur near an output frequency of 990.0 Hz.

4-58. E and F Main Loop Steering Voltage Adjust

a. Connect the high lead of the voltmeter to TP5 and the low lead to TP14.

b. Select a 6010A output frequency of 99.9999 kHz.

c. Adjust T2 for a voltmeter reading of –0.17 ±0.03 volts.

d. Change the 6010A output frequency to 99.9900 kHz. (Use the FREQUENCY EDIT control.)

e. Vary the 10 kHz through 10 Hz digits, observing the minimum and maximum voltmeter readings. The maximum will likely occur near an output frequency of 99.0900 kHz and should be less than 0.15 volts (adjust T2 as

necessary to maintain the maximum below 0.15 volts). The minimum should be greater than –0.50 volts and should occur near an output frequency of 99.0000 kHz.

f. Disconnect all test equipment.

4-59. Front Panel PCB Adjustments

4-60. The adjustments for output level and the REDUCE OUTPUT LEVEL indicator threshold are located on the Front Panel PCB. In a repair or calibration effort these two adjustments should be the last to be adjusted. Two holes in the top edge of the front panel sheet metal provide access to these two adjustments. As viewed from the front and adjustment on the right is R14 and the left one is R20. Make these two adjustments as follows:

a. Connect the high lead of a voltmeter to TP4 and the low lead to TP2 (Test points located on the back side of the Front Panel PCB).

b. Select a 6010A output freuqency of 1 kHz.

c. Rotate the OUTPUT LEVEL control fully clockwise.

d. The voltmeter should indicate –5.0 ±0.35 volts.

NOTE

The adjustment in step e will affect the voltage reading in step d. It may be necessary to repeat steps c, d, e and f several times before both are within the calibration tolerances.

e. Rotate the OUTPUT LEVEL control fully counterclockwise.

f. Adjust R14 for a voltmeter reading within 2 millivolts of the reading noted in step d divided by 20 (step d reading ÷ 20 ±2 mV).

g. Repeat steps c through f until both readings are within tolerance limits.

h. Rotate the OUTPUT LEVEL control fully clockwise.

i. Connect a shorting clip between TP1 and TP2.

j. Adjust R20 until the REDUCE OUTPUT LEVEL indicator just comes on. Remove the shorting clip from TP1 and TP2. The REDUCE OUTPUT LEVEL light should go out.

4-61. TROUBLESHOOTING

4-62. Troubleshooting of the Model 6010A can be categorized into three separate conditions: (1) Catastrophic, where no outputs are present, (2) Frequency errors, where incorrect output frequencies are obtained and (3) Output Level errors, where incorrect output levels are obtained. The first malfunction can usually be attributed to a power supply problem. Isolation of frequency and output level errors, however, is somewhat more difficult and may require a thorough understanding of the synthesizer and controller block diagrams. Consult Section 3 of this manual for a discussion of these block diagrams. Also consult the previous portion of this section for recommended test equipment, performance checks and calibration procedures.

CAUTION

All MOS gate insulated devices can be damaged by the presence of excessively high electric fields in the gate oxide region. Such fields can cause the gate-oxide to rupture forming a conductive path which destroys the device. It is common for anyone to build up such charges on their person and, depending on conditions, to transfer this charge to anything they touch. Refer to the following paragraph for proper handling procedures.

4-63. MOS Device Handling Procedures ⓧ

4-64. The following procedures will minimize the possibility of damage to the MOS device during handling.

a. Table tops where MOS devices are handled should be conductive and at ground potential. Also, insure that the instrument is grounded to the work bench before any work is performed.

b. Personnel handling MOS devices should touch the grounded conductive surface before touching the devices.

c. Leads of MOS devices should be shorted together with a metal ring or inserted into conductive foam material when removed from a printed circuit board.

d. Dropping or mishandling of MOS devices must be avoided due to possible contact with charged surfaces or objects. If dropped or mishandled, the devices should be retested before being used.

e. MOS devices should NOT be placed in conventional plastic "foam" or polystyrene type holders used for storage and transportation of non-gate insulated semiconductor devices.

f. When PC boards containing mounted MOS devices are removed from equipment for test, shipping, storage, etc., "dummy" connectors should be used to electrically short all PC board terminals together. Sufficient energy can be radiated into the land patterns of a PC board to cause damage without physical contact with the source.

g. Soldering irons used for soldering MOS device leads must have grounded tips.

h. All equipment coming in contact with MOS devices should be checked for excessive voltages.

i. Do not insert or remove MOS devices from test circuits with voltages applied.

j. All MOS devices in this instrument will be indicated by a flag note and a list of the MOS devices by reference designation.

4-65. Frequency Error

4-66. When a frequency error is either known or suspected to exist, use the following steps as an aid to isolating the problem.

a. Connect the frequency counter, terminated in 50 ohms, to the 6010A Front Panel output connector.

b. Rotate the 6010A OUTPUT LEVEL control fully clockwise.

c. Set the 6010A LEVEL to the 50 - 500 mV band.

d. Select the output frequencies listed in Table 4-3 and observe the counter for a corresponding reading within the limits specified. One frequency being slightly out of tolerance would suggest a calibration error. All frequencies being in error would suggest a component malfunction.

Table 4-5. OUTPUT FREQUENCY ACCURACY

6010A SELECTED FREQUENCY	COUNTER DISPLAY
100 kHz	99,999.7 to 100,000.3 Hz
1 MHz	999,997 to 1,000,003 Hz
5 MHz	4,999,985 to 5,000,015 Hz
10 MHz	9,999,970 to 10,000,030 Hz

NOTE

The above procedure is used to verify the output frequency accuracy at the most critical frequencies.

e. If the problem appears to be in calibration, refer to 4-24.

4-67. The following steps are provided as an aid to troubleshooting with the assumption that the indications, thus far, suggest a component malfunction. These steps will attempt to isolate the malfunction to a module.

a. Refer to 4-6, MAINTENANCE ACCESS, for the correct procedure to gain access to the various circuit boards in this instrument.

b. Check the output frequency of the 10 MHz oscillator in accordance with 4-30 through 4-31.

c. Use Table 4-6 to provide input data while performing items 1 and 2 of the Frequency Error Isolation Chart (Table 4-7). Observe the output frequencies at the Front Panel Output, the Front Panel Display and the voltage level at the various pins of J3 on the Main PCB. Program the first frequency manually, then use the Self Test feature (outlined on the top cover of the instrument) to obtain the other frequencies. This operation checks the RAMS, CPU, MEMORY INTERFACE, ROM and Synthesizer latches. Answer item 1 of the Frequency Error Isolation Chart.

d. Repeat step c, except this time, program all frequencies manually. This checks the KEY-

BOARD, KEYBOARD INPUT port, CPU, MEMORY INTERFACE and another portion of the ROM. Answer item 2 of the Frequency Error Isolation Chart.

e. This indicates a problem in the controller group (U24, 26, 27, 28, 29 and 30) on the Main PCB. Since these CMOS devices constitute a high speed computer, they are mounted in sockets and require special handling. Refer to 4-62 through 4-64 for special handling procedures of MOS devices. Starting with the RAMs, replace one device at a time with a new device until the faulty device is located.

f. Trigger scope on TP5 of the Main PCB. Observe the pulses at the following points on the Main PCB.

1. J2-22 while pressing switches 0, 4, 8.
2. J2-21 while pressing switches 1, 5, 9.
3. J2-11 while pressing switches 2, 6, DP.
4. J2-9 while pressing switches 3, 7.

4-69. When an Output Level error is known or suspected to exist, use the following steps as an aid to isolating the problem.

4-68. Output Level Error

a. Select the 0.5 - 5 mV level band.

b. Rotate the Output Level Vernier fully clockwise.

c. Connect an AC voltmeter to the Front Panel output. Select a minimum range of 10V. The Output Level may be varied from 0.25 mV rms to 5V rms (0.13 mV avg. to 4.5V avg.).

d. Select the 0.5 - 5V level band. Consult Table 4-6 for troubleshooting procedure.

Table 4-6. SYNTHESIZER COMMANDS

DECADES		10 MHz	f 1 MHz	e 100 kHz	d 10 kHz	c 1 kHz	b 100 Hz	a 10 Hz
CONNECTOR J3 MAIN PCB		12	33 32 31 34	21 26 25 22	17 24 20 23	28 30 27 29	6 9 5 10	13 14 11 16
START	FREQ MHz	Ø	Ø	DP Ø	Ø	Ø	Ø	Ø
BCD INPUT LEVELS		L	L L L L	L L L L	L L L L	L L L L	L L L L	L L L L
RECALL 1	FREQ MHz	Ø	1	DP 1	1	1	1	1
BCD INPUT LEVELS		L	H L L L	H L L L	H L L L	H L L L	H L L L	H L L L
RECALL 2	FREQ MHz	Ø	2	DP 2	2	2	2	2
BCD INPUT LEVELS		L	L H L L	L H L L	L H L L	L H L L	L H L L	L H L L
RECALL 3	FREQ MHz	Ø	3	DP 3	3	3	3	3
BCD INPUT LEVELS		L	H H L L	H H L L	H H L L	H H L L	H H L L	H H L L
RECALL 4	FREQ MHz	Ø	4	DP 4	4	4	4	4
BCD INPUT LEVELS		L	L L L H	L L L H	L L L H	L L L H	L L L H	L L L H
RECALL 5	FREQ MHz	Ø	5	DP 5	5	5	5	5
BCD INPUT LEVELS		L	H L H L	H L H L	H L H L	H L H L	H L H L	H L H L
RECALL 6	FREQ MHz	Ø	6	DP 6	6	6	6	6
BCD INPUT LEVELS		L	L H H L	L H H L	L H H L	L H H L	L H H L	L H H L
RECALL 7	FREQ MHz	Ø	7	DP 7	7	7	7	7
BCD INPUT LEVELS		L	H H H L	H H H L	H H H L	H H H L	H H H L	H H H L
RECALL 8	FREQ MHz	Ø	8	DP 8	8	8	8	8
BCD INPUT LEVELS		L	L L L H	L L L H	L L L H	L L L H	L L L H	L L L H
RECALL 9	FREQ MHz	Ø	9	DP 9	9	9	9	9
BCD INPUT LEVELS		L	H L L H	H L L H	H L L H	H L L H	H L L H	H L L H
RECALL 0	FREQ kHz	1	Ø	9	DP 8	7	6	5
BCD INPUT LEVELS		H	L L L L	H L L H	L L L H	H H H L	L H H L	H L H L

Table 4-7. FREQUENCY ERROR ISOLATION CHART

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
1	Is the BCD input data from the RAMs correct? Refer to 4-67c for procedure.	2	5
2	Is the BCD input data from the Keyboard correct? Refer to 4-67d for procedure.	3	6
3	Is the output frequency at J4 of the 6-Digit Generator module (4102) correct? This frequency should equal the sum of the Front Panel Output and 200 kHz in the LOW Range and the sum of the Front Panel Output and 20 MHz in the HIGH Range.	9	4
4	The problem is in the 6-Digit Generator module (4102).		
5	Is the BCD input data from the Keyboard correct?	4-67e	10
6	Is correct data present at Keyboard Input port? Refer to 4-67f.	7	13
7	Is the input enable strobe present at U1-7 of the Main PCB (4004)?	8	4-67e
8	Input port device, U1, 2, 3 or 4, on Main PCB (4004) is likely the fault.		
9	The problem is in the Input-Output module (4101).		
10	Is the output strobe present at U5-5 of the Main PCB (4004)?	11	4-67e
11	Are outputs Y0-Y4 present at U5-15 through 11 of the Main PCB (4004)?	12	15
12	Are strobes DT1-DT7 present at U7-2 through 7 and 9 of the Main PCB (4004)?	4-67e	16
13	Are strobes DT1-DT7 present at RN1-3, 2, 7, 6, 5, 4 and 1 of the Display Panel module (4005)?	14	17
14	The Keyboard switches are faulty.		
15	U5 is faulty.		
16	U6, 7, 17 or 18 is faulty.		
17	Are strobes DT1-DT7 present at U7-2 through 7 and 9 of the Main PCB (4004)?	18	19
18	Suspect faulty connector between Main PCB and Display Panel module (4005).		
19	Are outputs Y0-Y4 present at U5-15 through 11 of the Main PCB (4004)?	16	20
20	Is the output strobe present at U5-5 of Main PCB (4004)?	15	4-67e

Table 4-8. OUTPUT LEVEL ERROR ISOLATION CHART

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
1	Did the Level indicators change correctly?	2	4
2	Is the Front Panel Output Level +5V rms (+4.5V avg)?	3	7
3	Is the Output Level variable over the entire level range using the Output Level Vernier on the Front Panel?	18	19
4	Is +5V present at the anode of DS10, 11, 12 and 13 of the Display Panel module (4005)?	5	13
5	Does a low condition occur at J2-17, 19, 20 and 18 of the Main PCB (4004) during the DT2 strobe at J1-12 of the Main PCB?	6	16
6	The problem is a faulty connector, resistor pack RN4 or level leds.		
7	Is the level at J3 of the Attenuator module (4103) +5V rms?	8	19
8	Is the Output Level limit 5 mV rms?	9	10
9	K2 and K3 on the Attenuator module are not energizing.		
10	Is the Output Level limit 50 mV rms?	11	12
11	K2 on the Attenuator module (4103) is not energizing.		
12	Is the Output Level limit 500 mV rms?	13	3
13	K3 on the Attenuator module (4103) is not energizing.		
14	Is the DT2 strobe present at RN1-2 on the Display Panel module (4005)?	15	17
15	The problem is RN1 or Q2 on the Display Panel module (4005).		
16	Check the output port U20 and U21 on the Main PCB (4004).		
17	Check the strobe generator circuits U7, 6, 17, 18 and 5 on the Main PCB (4004).		
18	There is no problem with the output level.		
19	Is the level at TP4 of the Input-Output module variable?	20	21
20	The problem is on the Input-Output module. Check in accordance with CALIBRATION 4-34 through 4-39 and 4-44 through 4-47.		
21	The problem is on the Display Panel module (4005). Check in accordance with CALIBRATION 4-59 through 4-60.		

Section 5
Lists of Replaceable Parts

TABLE OF CONTENTS

NAME	PART NO.	PAGE
6010A Final Assembly		5-4
Input/Output Module Assembly	388041	5-10
Input/Output PCB Assembly	387985	5-10
Six-Digit Module Assembly	388058	5-21
Attenuator Module Assembly	388066	5-31
Main PCB Assembly	388017	5-34
Display PCB Assembly	388033	5-39

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. Components are listed alpha-numerically by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. Component location illustrations are contained in Section 8 along with the respective schematic.

5-3. Parts lists include the following information:

a. Reference Designation or Item Number.

b. Description of each part.

c. FLUKE Stock Number.

d. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)

e. Manufacturer's Part Number or Type.

f. Total Quantity per assembly or component.

g. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended quantity of the item in that particular assembly.

h. Use Code is provided to identify certain parts that have been added, deleted or modified during production of the instrument. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity, paragraph 5-7.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation or Item Number.

e. Printed Circuit Board Part Number.

f. Instrument Model and Serial Number.

5-7. USE CODE EFFECTIVITY LIST

USE CODE	SERIAL NUMBER EFFECTIVITY

Table 5-1. FINAL ASSEMBLY (Sheet 1 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY (Figure 5-1 Sheet 1, 2 & 3) Main Chassis, (Figure 5-1 Sheet 1)						
C16	Capacitor, elect, 15,000 μF, -10/+75%, 15V	310367	06001	86F520	1		
F1	Fuse, slow–blow, 1A, 250V	109272	71400	MDL-1	1	5	
T1	Xfmr Assy	396903	89536	396903	1		
XF1	Fuse Holder	407775	75915	341-001AL	1		
1	Fan, venturi	255562	89536	255562	1		
2	Rear Corner, finished	406702	89536	406702	2		
3	Rear Panel	390518	89536	390518	1		
4	Fan, finger guard	407650	82877	476042	1		
5	Cord & Plug	102822	70903	PVC/PH-70	1	1	
6	Bushing, strain relief	101162	28520	SR5P-4	1		
7	Chassis, side, L.H.	387902	89536	387902	1		
8	Clamp, capacitor mounting	185801	56289	4586-97A	1		
9	Nut, self locking	152819	78199	511-0618000-00	11		
10	Lug, solder, copper	169409	79963	29A	1		
11	Lug, solder, brass	101030	79963	174	2		
12	Screw, nylon, steel core, 6/32 x 1/4 R.H.	272799	89536	272799	3		
13	Support, heat sink	405449	89536	405449	1		
14	Chassis, side, R.H.	387910	89536	387910	1		
15	Corner, finished	406694	89536	406694	2		
16	Pushbutton, green	268862	71590	J61993	1		
17	Front Panel Assy	392282	89536	392282	1		
18	Main PCB Assy, tested, 6010A-4004	388017	89536	388017	1		
19	Bumper, rubber	358341	52152	SJ5003	3		

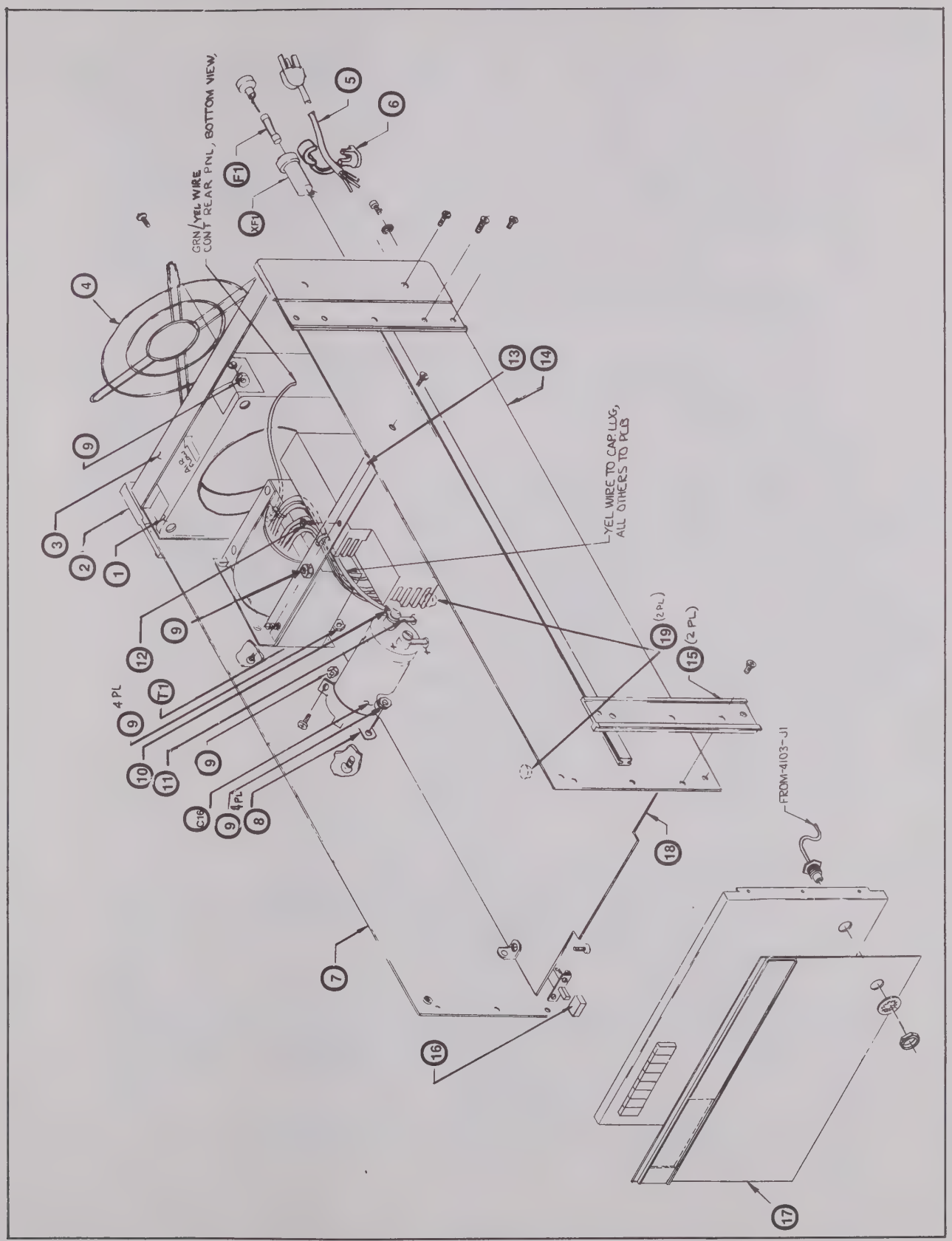
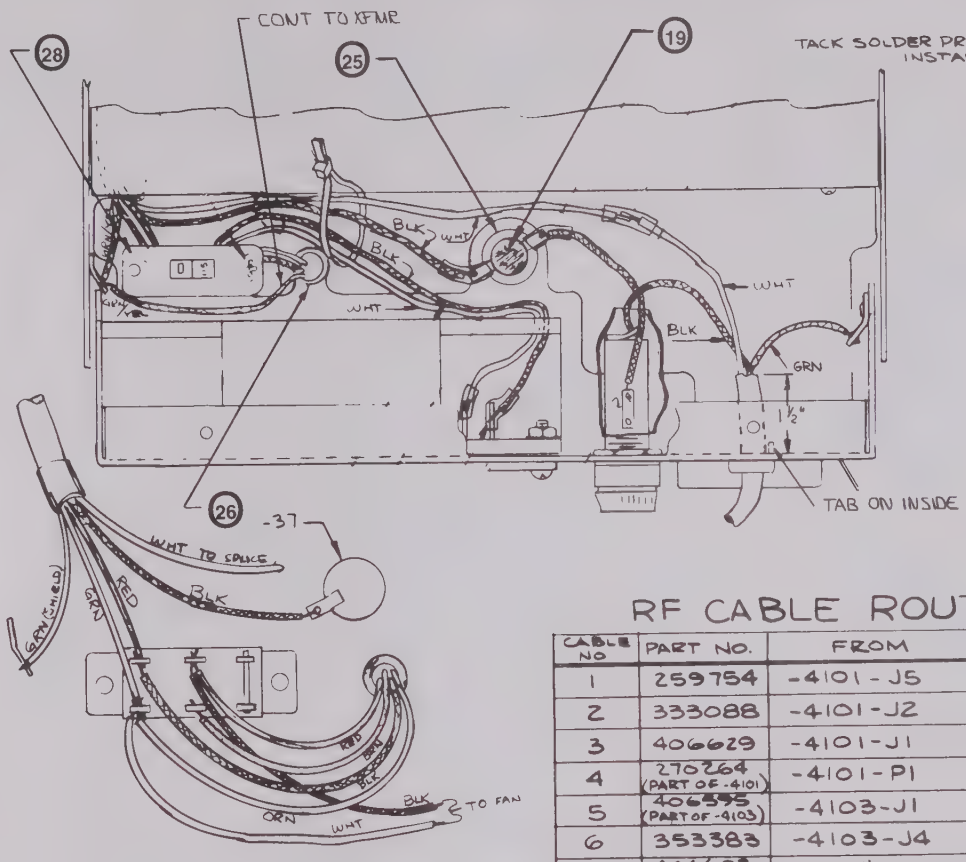


Figure 5-1. FINAL ASSEMBLY (Sheet 1 of 3)

Table 5-1. FINAL ASSEMBLY (Sheet 2 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	Input Power and Module (Figure 5-1 Sheet 2)						
20	Input/Output Module Assy., tested, 6010A-4101	388041	89536	388041	1		
21	Six Digit Module Assy., tested, 6010A-4102	388058	89536	388058	1		
22	Attenuator Module Assy., tested, 6010A-4103	388066	89536	388066	1		
23	Display Panel PCB Assy., 6010A-4005	388033	89536	388033	1		
24	Screw, 4-40 x 3/8, cad-plated	256024	89536	256024	20		
25	Thermostat, snap action, SPST, 15A @ 120V ac/30V dc	344002	89536	344002	1		
26	Bushing, snap, black nylon, 1/4 in.	102996	28520	SB-375-4	1		
27	Anchor, cable 1/8 x 3/4	408443	06915	KKC2	14		
28	Switch, slide, DPDT 115-230V	226274	82389	46256LFE	1	1	
29	Cable Guard	406967	89536	406967	1		
30	Tape, vinyl foam	330043	34359	4516	1.0ft		
	Table, RF Cable Routing 6010A						



RF CABLE ROUTING

CABLE NO	PART NO.	FROM	TO
1	259754	-4101-J5	R. PNL "EXT REF"
2	333088	-4101-J2	-4102-J1
3	406629	-4101-J1	-4102-J4
4	270264 (PART OF -4101)	-4101-P1	-4103-J3
5	406595 (PART OF -4103)	-4103-J1	F. PNL "OUTPUT"
6	353383	-4103-J4	R. PNL "TTL OUT"
7	406603 (PART OF -4004)	-4004 "10 MHz IN"	-4101-J3
8	406646 (PART OF -4004)	-4004 "BUFFER OUT"	R. PNL "REF OUT"
9	406652 (PART OF -4004)	-4004 "AM IN"	R. PNL "AM IN"

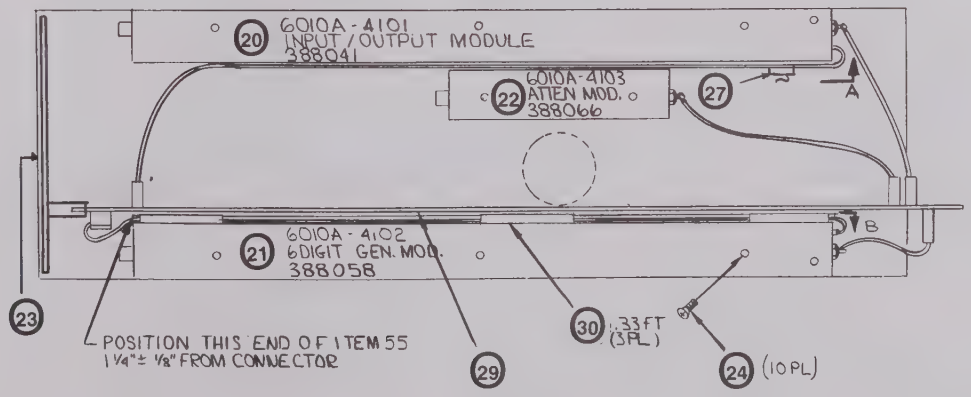


Figure 5-1. FINAL ASSEMBLY (Sheet 2 of 3)

Table 5-1. FINAL ASSEMBLY (Sheet 3 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
31	Handle Grip	284836	89536	284836	2		
32	Handle Frame	310045	89536	310045	1		
33	Decal, operating instructions	413203	89536	413203	1		
34	Cover, top	387878	89536	387878	1		
35	Decal	296269	89536	296269	4		
36	Decal, side trim	407924	89536	407924	2		
37	Cover, bottom	387886	89536	387886	1		
38	Knob, half, black	309054	89536	309054	2		
39	Washer, spring	228981	89536	228981	2		
40	Knob, male half, black	309047	89536	309047	2		
41	Decal, knob, spun finish	285221	89536	285221	2		
42	Decal, specifications	413674	89536	413674	1		
43	Foot, bail stand	292870	89536	292870	4		
44	Insert, non-skid, foot	302026	89536	302026	4		
45	Decal, caution, H.V.	232116	89536	232116	1		
46	Screw, FH, undercut 6-32 x 1/4	320093	89536	320093	2		
47	Screw, FH, countersunk 8-32 x 1	114561	89536	114561	2		
	Instruction Manual	409714	89536	409714	1		

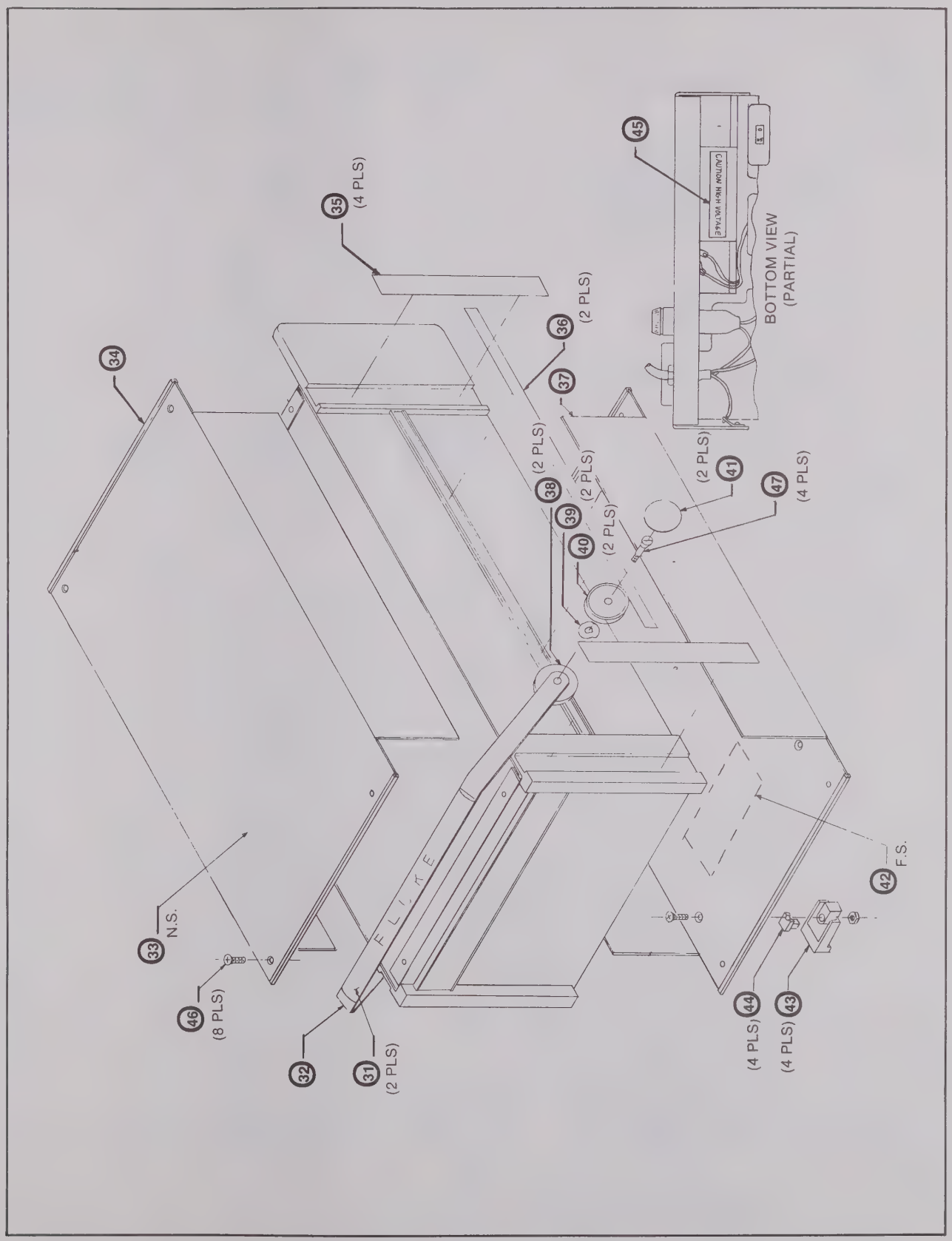


Figure 5-1. FINAL ASSEMBLY (Sheet 3 of 3)

Table 5-2. INPUT/OUTPUT MODULE (Sheet 1 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	INPUT/OUTPUT MODULE ASSEMBLY (6010A-4101)	388041	89536	388041	1		
	Cover, Module, Outer	390559	89536	390559	1		
	Cover, Module, Inner	416438	89536	416438	1		
	PCB ASSEMBLY, INPUT/OUTPUT (Figure 5-2)	387985	89536	387985			
C1, 5, 34, 36, 37, 48, 50, 51, 53, 54, 55, 56, 60, 75, 76, 80, 81, 91, 92, 112	Cap, ta, 10 μF ±20%, 20V	330662	56289	196D106X0020-KA1	20		
C2, 3, 14	Cap, ta, 4.7 μF, 25V	161943	56289	196D475X0025-PE4	3		
C4, 124	Cap, mica, 12 pF, ±5%, 500V	175224	71236	DM15C012J	2		
C6	Cap, mica, 61 pF, ±5%, 500V	277210	71236	DM15E051J	1		
C7, 20, 22, 28, 35, 45, 79, 99, 102, 103, 104, 118, 119, 120,	Cap, cer, 0.01 μF, ±20%, 100V	149153	56289	C023B101F103M	14		
C8, 9, 19, 31, 33 38, 47, 52, 127	Cap, ta, 68 μF, ±20%, 15V	193615	56289	196D686X0015-LA3	9		

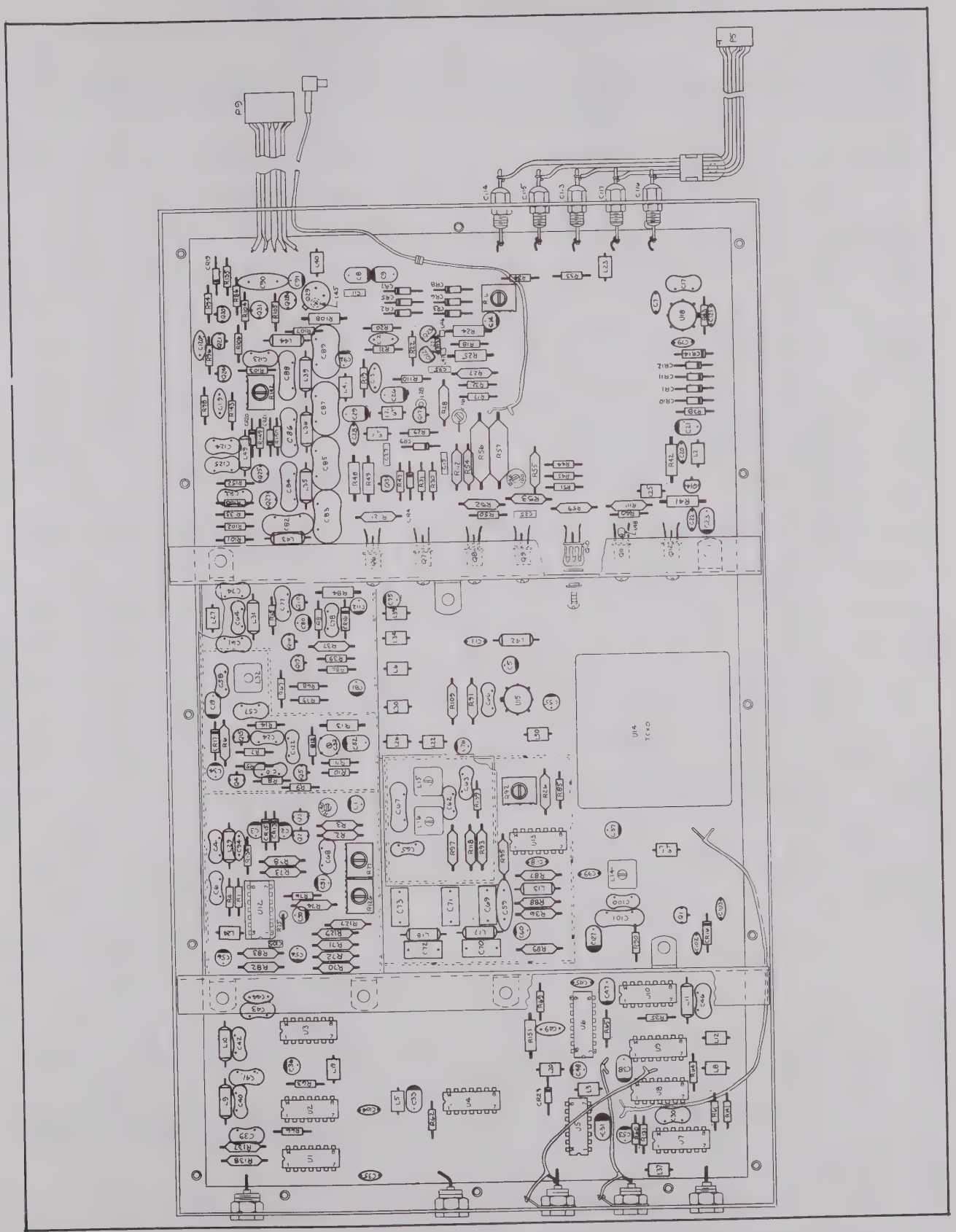


Figure 5-2. INPUT/OUTPUT PCB ASSEMBLY COMPONENT LOCATION (6010A-1601)

Table 5-2. INPUT/OUTPUT MODULE (Sheet 2 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C10	Cap, mica, 56 pF, ±5%, 500V	148528	71236	DM15F560J	1		
C11, 15, 25, 27, 95	Cap, cer, 0.22 μF, ±20%, 50V	309849	71590	CW30C224K	5		
C12, 13, 44, 49, 94	Cap, cer, 0.05 μF, ±20%, 100V	149161	56289	55C23A1	5		
C16	Cap, var, 0.25 - 1.5 pF, 2000V	218206	32897	530-000	1	1	
C17, 67	Cap, mica, 430 pF, ±5%, 500V	177980	71236	DM15F431J	2		
C21, 26	Cap, ta, 6.8 μF, ±20%, 35V	363713	56289	196D685X0035-KA1	2		
C23, 29	Cap, ta, 22 pF, ±20%, 35V	394775	56289	196D226X0035-TE4	2		
C24, 77	Cap, mica, 10 pF, ±10%, 500V	175216	71236	DM15C0100K	2		
C30	Cap, mica, 360 pF, ±5%, 500V	325878	71236	DM15F361J	1	1	
C32	Cap, variable (2-22 pF)	369207	73445	C010KA/20E	1		
C39, 43, 57	Cap, mica, 130 pF, ±5%, 500V	266205	71236	DM15F131J	3		
C40	Cap, mica, 33 pF, ±5%, 500V	160317	71236	DM15E330J	1		
C41, 74	Cap, mica, 220 pF, ±5%, 500V	170423	71236	DM15F221J	2		
C42, 62, 63, 64, 125	Cap, mica, 22 pF, ±5%, 500V	148551	71236	DM15C220J	5		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 3 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C46	Cap, mica, 110 pF, ±1%, 500V	170415	71236	DM15F111F	1		
C58, 65	Cap, mica 39 pF, ±5%, 500V	148544	71236	DM15E390J	2		
C59, 90	Cap, cer, disc, 0.1 μF, ±20%, 100V	149146	56289	33C41B6	2		
C61	Cap, mica, 270 pF, ±5%, 500V	148452	71236	DM15F271J	1		
C66	Cap, mica, 30 pF, ±5%, 500V	340570	71236	DM15E300J	1		
C68, 84	Cap, mica, 390 pF, ±5%, 500V	148437	71236	DM15F391J	2		
C69	Cap, mylar, 0.012 μF, ±10%, 50V	402883	06001	75F1R5A123	1		
C70	Cap, mylar, 0.0033 μF, ±10%, 50V	402867	06001	75F1R5A332	1		
C71	Cap, mylar, 0.033 μF, ±10%, 50V	271841	06001	75F3R5A333	1		
C72	Cap, mylar, 0.0015 μF, ±10%, 50V	402859	06001	75F1R5A152	1		
C73	Cap, mylar, 0.015 μF, ±10%, 50V	402891	06001	75F1R5A153	1		
C78	Cap, mica, 5 pF, ±10%, 500V	148577	71236	DM15C050K	1		
C82	Cap, mica, 1000 pF, ±5%, 500V	148387	71236	DM19F102J	1		
C83	Cap, mica, 5000 pF, ±5%, 500V	181065	71236	DM19F502J	1		
C85	Cap, mica, 7500 pF, ±5%, 500V	402933	71236	DM19F752J	1		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 4 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C86	Cap, mica 1200 pF, ±5%, 500V	148379	71236	DM19F122J	1		
C87	Cap, mica, 6800 pF, ±2%, 100V	408252	71236	DM19F682G	1		
C88	Cap, mica 680 pF, ±5%, 500V	148403	71236	DM19F681J	1		
C89	Cap, mica, 5600 pF, ±2%, 300V	182873	71236	DM19F562G	1		
C93	Cap, mica, 47 pF, ±5%, 500V	148536	71236	DM15E470J	1		
C100	Cap, cer, 39 pF, ±5%, 1000V	417410	56289	10TCR039	1		
C101	Cap, mica, 510 pF, ±5%, 500V	148411	71236	DM19E511J	1		
C105	Cap, cer, 1200 pF, ±20%, 100V	358283	71590	8121-A100-W5R-122M	1		
C111	Cap, cer, 0.005 μF, ±20%, 50V	175232	56289	C023B101E-502M	1		
C113 thru 117	Cap, feed-thru, 2500 pF, 500V	248286	00656	BSF1BB252GM	5		
C121	Cap, cer, 0.0012 μF, ±10%, 500V	106732	71590	CF122	1		
C122	Cap, mica, 4 pF, ±5%, 500V	190397	71236	DM15C040J	1		
C123	Cap, mica, 200 pF, ±5%, 500V	272880	71236	DM15F201J	1		
CR1 thru 12 C19 thru 21	Diode, 150 mA	203323	07910	1N4448	15	3	
CR13, 15	Diode, zener, 10%, 10V	113324	07910	1N961A	2	1	
CR14	Diode, zener, 5%, 20V	180463	07910	1N968B	1	1	
CR16	Diode, zener, 5%, 12V	249052	07910	1N963B	1	1	
CR17	Diode, zener, 10%, 3.9V	113316	07910	1N748	1	1	
CR18	Diode, zener, ±10%, 6.8V	342527	07910	TD333719	1	1	
CR23	Diode, zener, 5%, 5.1V	159798	07910	IN751A	1	1	

Table 5-2. INPUT/OUTPUT MODULE (Sheet 5 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
L1 thru 3, L5 thru 8, 12, L19 thru 27, 30, 33, 34, 37, 40, 41, 50	Choke, RF, 6-turn	320911	89536	320911	24		
L9, 10	Inductor, 0.27 μH, ±10%, 1625 mA	313031	24759	MR-0.27	2		
L11	Inductor, 0.56 μH, ±10%, 900 mA	402909	24759	MR-0.56	1		
L13	Inductor, 10 μH, ±10%, 480 mA	174730	72259	WEE10	1		
L14, 15, 16, 32	Inductor, RF 1.4 -1.9 μH	345850	89536	345850	4		
L17	Inductor, 39 μH, ±10%, 429 mA	344010	24759	MR39	1		
L18	Inductor, 47 μH, ±10%, 400 mA	249094	24759	MR47	1		
L28, 45 thru 48	Ferrite Bead, 1-turn	321182	02114	56-590-65-4B	5		
L29	Inductor, 3.9 μH, ±5%, 815 mA	413864	24759	MR-3.9	1		
L31	Inductor, 1.5 μH, ±5%, 1560 mA	413856	24759	MR-1.5	1		
L35, 36	Inductor, 560 μH, ±10%, 174 mA	363150	24759	MR560	2		
L39	Inductor 680 μH, ±10%, 163 mA	343848	24759	MR680	1		
L42	Inductor, 27,000 μH, ±10%, 34 mA	363192	24759	MR27000	1		
L43	Inductor, 1200 μH, ±10%, 125 mA	343855	24759	MR1200	1		
L44	Inductor, 470 μH, ±5%, 180 mA	147827	72259	WEE470	1		
L49	Inductor, 2.2 μH, ±10%, 1290 mA	413880	24759	MR-2.2	1		
P5	DC Cable Assy.	416594	89536	416594	1		
P9	DC Cable Assy.	416586	89536	416586	1		
Q1	Transistor, si, PNP	195974	04713	2N3906	1	1	

Table 5-2. INPUT/OUTPUT MODULE (Sheet 6 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
Q2, 3, 15, 17, 20	Transistor, si, PNP	343012	07263	2N4258	5	1	
Q4, 5, 14, 16, 19, 21, 24	Transistor, si, NPN	218081	04713	MPS6520	7	2	
Q6	Transistor, si, PNP	402586	04713	2N2905A	1	1	
Q7	Transistor, si, PNP	402578	04713	2N5160	1	1	
Q8	Transistor, si, NPN	407965	04713	2N3553	1	1	
Q9, 12	Transistor, si, NPN	179374	07263	2N2218	2	1	
Q10	Transistor, si, PNP	402560	04713	MM4019	1	1	
Q11	Transistor, si, NPN	402602	04713	MRF531	1	1	
Q13, 30	Transistor, si, PNP	229898	04713	MPS6522	2	1	
Q22, 23	Transistor, si, NPN	333898	04713	MPSH10	2	1	
Q25, 27 28, 31	Transistor, FET, n-channel, 30 mA, 40V	428169	11532	U2366E	4	1	
Q29	Transistor, si, NPN	272930	04713	2N5943	1	1	
R1, 22, 50, 51	Res, fxd, comp, 10, ±5%, 1/4W	147868	01121	CB1005	4		
R2, 3, 54, 55	Res, fxd, mf, 100, ±1%, 1/8W	168195	91637	MFF1-81000F	4		
R4	Res, fxd, comp, 240, ±5%, 1/4W	221895	01121	CB2415	1		
R5, 20, 21, 100	Res, fxd, comp, 270, ±5%, 1/4W	160804	01121	CB2715	4		
R6	Res, fxd, mf, 453, ±1%, 1/8W	267393	91637	MFF1-84530F	1		
R7, 39	Res, fxd, comp, 5.6, ±5%, 1/4W	208033	01121	CB56G5	2		
R8, 67	Res, fxd, comp, 4.7, ±5%, 1/4W	193359	01121	CB47G5	2		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 7 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R9, 10, 68, 79	Res, fxd, comp, 1.3k, ±5%, 1/4W	234252	01121	CB1325	4		
R11, 14, 15, 33, 66, 134	Res, fxd, comp, 100, ±10%, 1/4W	193185	01121	CB1011	6		
R12, 29, 101	Res, fxd, comp, 510, ±5%, 1/4W	218032	01121	CB5115	3		
R13, 84, 108	Res, fxd, comp, 680, ±5%, 1/2W	178392	01121	EB6815	3		
R16, 142	Res, var, cermet, 50k, ±10%, 1/2W	335778	71450	360T503A	2		
R17	Res, fxd, comp, 20k, ±5%, 1/4W	221614	01121	CB2035	1		
R18, 38, 61, 65, 69, 81, 110	Res, fxd, comp, 1k, ±5%, 1/4W	148023	01121	CB1025	7		
R19	Res, fxd, comp, 430, ±5%, 1/4W	203869	01121	CB4315	1		
R23	Res, fxd, comp, 27, ±10%, 1/8W	266254	01121	BB2701	1		
R24, 25	Res, fxd, comp, 22k, ±5%, 1/2W	108506	01121	EB2225	2		
R26	Res, fxd, mf, 402, ±1%, 1/8W	289611	91637	MFF1-84020F	1		
R27, 75, 83, 93, 95, 97, 118	Res, fxd, mf, 49.9, ±1%, 1/8W	305896	91637	MFF1-849R9F	7		
R28	Res, fxd, mf, 953, ±1%, 1/8W	288555	91637	MFF1-89530F	1		
R30	Res, fxd, mf, 221, ±1%, 1/8W	340794	91637	MFF1-82210F	1		
R31	Res, fxd, mf, 3.92k, ±1%, 1/8W	294801	91637	MFF1-83921F	1		
R32, 34, 60, 64, 94, 98, 104, 105, 143, 152	Res, fxd, comp, 10k, ±5%, 1/4W	148106	01121	CB1035	10		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 8 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R35	Res, fxd, comp, 91, ±5%, 1/4W	221887	01121	CB9105	1		
R36	Res, fxd, mf, 4.02k, ±1%, 1/8W	235325	91637	MFF1-84021F	1		
R37	Res, fxd, mf, 732, ±1%, 1/8W	294884	91637	MFF1-87320F	1		
R40	Res, fxd, comp, 18, ±5%, 1/4W	219022	01121	CB1805	1		
R41, 48	Res, fxd, comp, 2, ±5%, 1/2W	218735	01121	EB20G5	2		
R42, 49	Res, fxd, comp, 1k, ±5%, 1/2W	108597	01121	EB1025	2		
R43, 62	Res, fxd, comp, 5.1k, ±5%, 1/4W	193342	01121	CB5125	2		
R44	Res, fxd, comp, 22, ±5%, 1/4W	147884	01121	CB2205	1		
R45	Res, fxd, comp, 4.3, ±5%, 1/4W	268912	01121	CB43G5	1		
R46	Res, var, cermet, 100, ±20%, 0.5W	193052	32997	3329H-1-101	1	1	
R47	Res, fxd, mf, 22.6, ±1%, 1/8W	296640	91637	MFF1-822R6F	1		
R52, 53	Res, fxd, mf, 10, ±0.1%, 1/4W	424192	91637	MFF1-4A010B	2		
R56,57	Res, fxd, mf, 90.9, ±0.1%, 1/2W	423947	91637	MFF1-290R9B	2		
R59, 112	Res, fxd, mf, 24.3k, ±1%, 1/8W	236745	91637	MFF1-82432F	2		
R63	Res, fxd, mf, 3, ±5%, 1/4W	218040	01121	CB30G5	1		
R70	Res, fxd, mf, 301, ±1%, 1/8W	289173	91637	MFF1-83010F	1		
R71	Res, fxd, mf, 634, ±1%, 1/8W	289306	91637	MFF1-86340F	1		
R72	Res, fxd, mf, 649, ±1%, 1/8W	309955	91637	MFF1-86490F	1		
R73	Res, fxd, mf, 750, ±1%, 1/8W	289363	91637	MFF1-87500F	1		
R74	Res, fxd, mf, 499, ±1%, 1/8W	168211	91637	MFF1-84990F	1		
R76	Res, fxd, comp, 5.1, ±5%, 1/4W	281832	01121	CB51G5	1		
R77, 126	Res, var, cermet, 20, ±20%, 1/2W	275727	71450	360T200B	2	1	
R78	Res, fxd, mf, 7.32, ±0.05%, 1/2W	289355	91637	MFF1-87321A	1		
R80	Res, fxd, comp, 200, ±5%, 1/4W	193482	01121	CB2015	1		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 9 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R82	Res, fxd, mf, 422, ±1%, 1/8W	288506	91637	MFF1-84990F	1		
R85	Res, fxd, comp, 1.8k, ±5%, 1/4W	175042	01121	CB1825	1		
R86	Res, fxd, comp, 27k, ±5%, 1/4W	148148	01121	CB2735	1		
R87, 88	Res, fxd, mf, 182, ±1%, 1/8W	289579	91637	MFF1-81820F	2		
R89	Res, fxd, mf, 3.01k, ±1%, 1/8W	312645	91637	MFF1-83011F	1		
R90	Res, fxd, comp, 150, ±5%, 1/4W	147934	01121	CB1515	1		
R91, 109	Res, fxd, mf, 1.69k, ±1%, 1/8W	321414	91637	MFF1-81691F	2		
R92	Res, var, cermet, 500, ±10%, 1/2W	325613	71450	360T501A	1	1	
R96, 103, 106, 149, 150	Res, fxd, comp, 100k, ±5%, 1/4W	148189	01121	CB1045	5		
R102, 107	Res, fxd, comp, 300, ±5%, 1/4W	348276	01121	CB3015	2		
R111, 121	Res, fxd, mf, 301, ±1%, 1/8W	267740	91637	MFF1-83010F	2		
R127	Res, fxd, mf, 3.65, ±1%, 1/8W	236844	91637	MFF1-83R65F	1		
R129	Res, fxd, mf, 10, ±1%, 1/8W	268789	91637	MFF1-8A100F	1		
R131, 139	Res, fxd, comp, 2k, ±5%, 1/4W	202879	01121	CB2025	2		
R133	Res, fxd, film, 360, ±5%, 1/4W	352286	80031	CR251-45P360T	1		
R135	Res, fxd, comp, 3.9k, ±5%, 1/4W	148064	01121	CB3925	1		
R137	Res, fxd, mf, 51.1, ±1%, 1/8W	305904	91637	MFF1-851R1F	1		
R138	Res, fxd, mf, 68.1, ±1%, 1/8W	305995	91637	MFF1-868R1F	1		
R140	Res, var, comp, 1k, ±30%, 1/2W	193060	73138	62P-R1K	1	1	
R141	Res, fxd, comp, 1.5k, ±5%, 1/4W	148031	01121	CB1525	1		
R151	Res, fxd, comp, 20k, ±5%, 1/2W	169839	01121	EB2035	1		

Table 5-2. INPUT/OUTPUT MODULE (Sheet 10 of 10)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U1	IC, TTL, quad 2-input NAND gate (Schottky)	363580	01295	SN75S00N	1	1	
U2	IC, TTL, 35 MHz preset/decade, 6 bin/ctr	320747	01295	SN74176N	1	1	
U3	IC, TTL, MSI, decade ctr	293159	01295	SN7490N	1	1	
U4	IC, TTL, hex inverter	292979	01295	SN7404N	1	1	
U5	IC, TTL, MSI, decade ctr, dil	402545	01295	SN74L590N	1	1	
U6	IC, TTL, dual, 4-bit decade/bin/ctr	402552	01295	SN74390N	1	1	
U7	IC, TTL, MSI, retrig, mono/multi	293134	04713	MC8601P	1	1	
U8, 10	IC, TTL, POS NAND gates & inverters	292953	01295	SN7400N	1	1	
U12	IC, selected mixer	434563	89536	434563	1	1	
U13	IC, linear, 5 xstr, array	248906	95303	CA3046	1	1	
U14	Oscillator, IC/VCXO	381707	75378	010-0710-0	1	1	
U15	IC, op amp	271502	12040	LM301A	1	1	
U18	IC, op amp	329912	12040	LM318H	1	1	
XQ6, 8, 10, 12	Heat Sink	407270	13103	P11163	4		
XQ7, 9 11	Heat Sink, ber· washer	447524	05820	260-4TH5B	3		
XU12	Socket, IC 14 pin	370304	01295	C931402	1		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 1 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	SIX DIGIT MODULE ASSEMBLY (6010A-4102)	388058	89536	388058	REF		
	Cover, inner	416420	89536	416420	1		
	Cover, outer	390559	89536	390559	1		
	Magnetic shield	390922	89536	390922	2		
	SIX DIGIT GEN PCB ASSEMBLY (Figure 5-3)	387993	89536	387993	REF		
C1, C4, C30, C32, C33, C35, C37, C38, C42, C53 thru C58, C60, C63, C65, C67, C76, C93, C101, C104, C114, C115	Cap, 0.01 μF, $\pm$20%, 100V	149153	56289	C023B101F103M	25		
C2, C6, C15, C16, C19, C20, C21, C22, C23, C24, C25, C27, C29, C34, C43, C46, C47, C49, C50, C51, C72, C74, C83, C85 thru C91, C95 thru C98, C103 C110, C113	Cap, ta, 10 μF, $\pm$20%, 20V	330662	56289	196D106X0020-KA1	37		

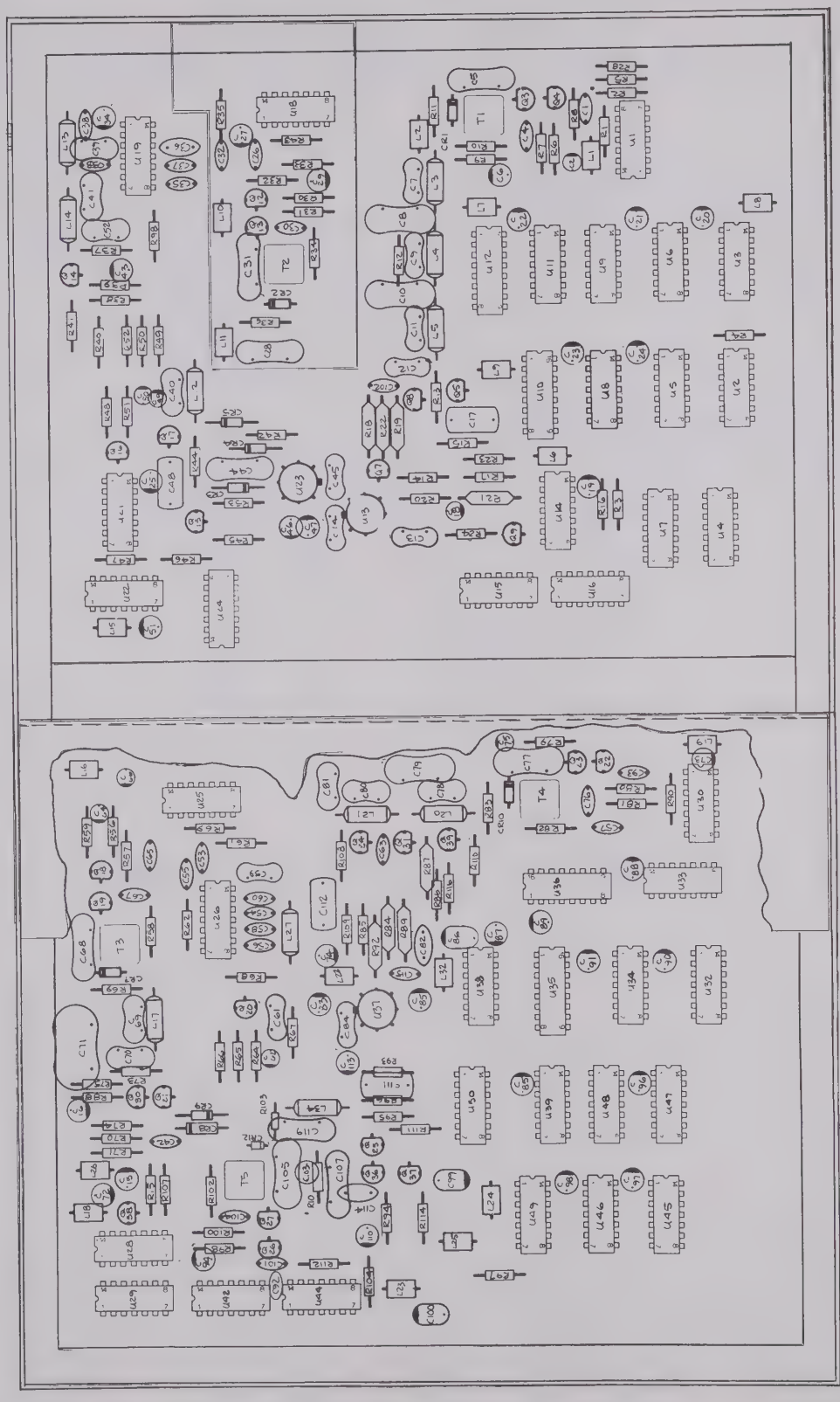


Figure 5-3. 6-DIGIT GENERATOR PCB ASSEMBLY COMPONENT LOCATION (6010A-1602)

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 2 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C5, C31, C44	Cap, mica, 1000 pF ±5%, 500V	148387	71236	DM19F102J	3		
C7	Cap, mica, 360 pF ±5%, 500V	325878	71236	DM15F361J	1		
C8, C10	Cap, mica, 1200 pF ±5%, 500V	148379	71236	DM19F122J	2		
C9, C12, C70	Cap, mica, 390 pF ±5%, 500V	148437	71236	DM15F391J	3		
C11	Cap, mica, 18 pF ±5%, 500V	266585	71236	DM15C180J	1		
C13	Cap, cer, 300 pF ±10%, 500V	105734	71590	BB60301KW7W	1		
C14, C45, C84	Cap, mica, 33 pF ±5%, 500V	160317	71236	DM15E330J	3		
C17	Cap, plstc, 0.033 μF ±10%, 250V	234492	73445	C280MAE/A33K	1		
C18	Cap, ta, 47 μF ±20%, 20V	348516	56289	196D476X0020-LA3	1		
C26	Cap, cer, 0.05 μF ±20%, 100V	149161	56289	55C23A1	1		
C28	Cap, mica, 1300 pF ±5%, 500V	182881	71236	DM19F132J	1		
C36, C82	Cap, cer, 0.0012 μF ±10%, 500V	106732	71590	CF122	2		
C39, C52	Cap, mica, 82 pF ±5%, 500V	148502	71236	DM15F820J	2		
C40, C41	Cap, mica, 150 pF ±5%, 500V	148478	71236	DM15F151J	2		
C48, C111 C112	Cap, plstc, 0.027 μF ±10%, 250V	267120	73445	C280AE/A27K	3		
C59, C61	Cap, mica, 91 pF ±5%, 500V	277228	71236	DM15F910J	2		
C62, C64, C66, C73, C75, C94	Cap, ta, 2.2 μF ±20%, 20V	161927	56289	196D225X0020-HA1	6		
C68, C77, C79, C104 C105	Cap, mica, 1500 pF ±5%, 500V	148361	71236	DM19F152J	5		
C69, C80	Cap, mica, 200 pF ±5%, 500V	272880	71236	DM15F201J	2		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 3 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
C71	Cap, plstc, 0.015 μF $\pm$10%, 200V	182154	14655	DMF2S15	1		
C78	Cap, mica, 270 pF $\pm$5%, 500V	148452	71236	DM15F271J	1		
C81	Cap, mica, 430 pF $\pm$5%, 500V	177980	71236	DM15F431J	1		
C92	Cap, cer, 2200 pF $\pm$10%, 500V	268425	32897	851-000Z5R-222K	1		
C99, C100	Cap, ta, 68 μF $\pm$20%, 15V	193615	56289	196D686X0015-LA3	2		
C102	Cap, ta, 1 μF $\pm$20%, 35V	161919	56289	196D105X0035-JA1	1		
C116, C117, C118	Cap, feed thru, 2500 pF, gmv, 500V	248286	04222	BSF1BB	3		
C119	Cap, mica, 480 pF $\pm$1%, 500V	182931	71236	DM19E481F	1		
CR1, CR2 CR7, CR10	Diode, matched pair	347534	89536	347534	2	1	
CR3, CR4 CR5, CR9	Diode, si, 150 mA	203323	07910	IN4448	4	1	
CR8	Diode, ge, 80 mA, 100 piv	149187	93332	IN270	1	1	
CR12	Diode, v var tuning	363812	04713	MV109	1		
J1 thru J4	Conn, male	207639	98291	51-049-0000	4		
L1, L2, L6 thru L11, L15, L16, L18, L19, L22 thru L26, L32	Choke, 6 turn	320911	89536	320911	18		
L3, L4, L5	Inductor, sub mini	363184	24759	MR-6800	3		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 4 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
L12	Inductor, 1000 μH, 140 mA	147819	72259	WEE1000	1		
L13, L14, L27	Inductor, 22 μH, 590 mA	147843	72259	WEE22	3		
L17	Inductor, 470 μH, 180 mA	147827	72259	WEE 470	1		
L20	Inductor, 39,000 μH, 31 mA	363200	24759	MR-39000	1		
L21	Inductor, 27,000 μH, 8 mA	363192	24759	MR-27000	1		
L33, L35	Tube ferrite	321182	02114	56-530-65-4B	2		
L34	Inductor, 100,000 μH, 22 mA	363226	24759	MR-1000,000	1		
P11	DC, power cable	416602	89536	416602	1		
P14	Connector, flat cable	325910	35037	3424	1		
Q3, Q4, Q9, Q12, Q13, Q16, Q18, Q19, Q22, Q23, Q26, Q27, Q37, Q38, Q39	Xstr, si, NPN	248351	04713	MPS918	15	3	
Q5, Q14, Q15, Q20, Q21, Q24, Q25	Xstr, si, NPN	218396	04713	2N3904	7	2	
Q7	Xstr, si, PNP	229898	04713	MPS6522	1	1	
Q8, Q17, Q30, Q31, Q36	Xstr, si, PNP	226290	04713	MPS3640	5	1	
R1, R43, R56, R57, R69, R80, R81, R90, R99, R100, R112	Res, comp, 1.2k ±5%, 1/4W	190371	01121	CB1225	11		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 5 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R3, R16, R41, R67, R70, R94	Res, comp, 6.2k ±5%, 1/4W	221911	01121	CB6225	6		
R4, R40, R66	Res, comp, 1k ±5%, 1/4W	148023	01121	CB1025	3		
R5, R9, R33	Res, comp, 270 ±5%, 1/4W	160804	01121	CB2715	3		
R6, R7, R30, R31	Res, comp, 1.8k ±5%, 1/4W	175042	01121	CB1825	4		
R8, R32, R107	Res, comp, 4.3k ±5%, 1/4W	193375	01121	CB4325	3		
R10, R11, R14, R34, R36, R58, R63, R82, R83, R102	Res, comp, 100 ±5%, 1/4W	147926	01121	CB1015	10		
R12, R110	Res, comp, 47k ±5%, 1/4W	148163	01121	CB4735	2		
R13, R104	Res, comp, 2k ±5%, 1/4W	202879	01121	CB2025	2		
R15	Res, comp, 560k ±5%, 1/4W	220541	01121	CB5645	1		
R17, R50, R85	Res, comp, 3.9k ±5%, 1/4W	148064	01121	CB3925	3		
R18	Res, mf, 3.92k ±1%, 1/8W	294801	91637	MFF1-83921F	1		
R19	Res, mf, 3.83k ±1%, 1/8W	235143	91637	MFF1-83831F	1		
R20	Res, comp, 62 ±5%, 1/4W	261842	01121	CB6205	1		
R21	Res, mf, 750 ±1%, 1/8W	312801	91637	MFF1-A751F	1		
R22	Res, mf, 9.09k ±1%, 1/8W	221663	91637	MFF1-89091F	1		
R23, R37, R38, R64, R68, R86	Res, comp, 820 ±5%, 1/4W	148015	01121	CB8215	6		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 6 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R24	Res, comp, 560 ±5%, 1/4W	147991	01121	CB5615	1		
R28	Res, comp, 51 ±5%, 1/4W	221879	01121	CB5105	1		
R35	Res, comp, 300 ±5%, 1/4W	348276	01121	CB3015	1		
R39, R65	Res, comp 10 ±5%, 1/4W	147868	01121	CB1005	2		
R42, R71	Res, comp, 15k ±5%, 1/4W	148114	01121	CB1535	2		
R44	Res, comp, 680 ±5%, 1/4W	148007	01121	CB6815	1		
R45	Res, comp, 2m ±5%, 1/4W	268771	01121	CB2055	1		
R46	Res, comp, 30k ±5%, 1/4W	193417	01121	CB3035	1		
R47, R96, R115	Res, comp, 7.5k ±5%, 1/4W	193326	01121	CB7525	3		
R48, R95	Res, comp, 10k ±5%, 1/4W	148106	01121	CB1035	2		
R49	Res, comp, 9.1k ±5%, 1/4W	193318	01121	CB9125	1		
R51	Res, comp, 12k ±5%, 1/4W	159731	01121	CB1235	1		
R52	Res, comp, 1.3k ±5%, 1/4W	234252	01121	CB1325	1		
R53	Res, comp, 120k ±5%, 1/4W	193458	01121	CB1245	1		
R59, R79	Res, comp, 3.3k ±5%, 1/4W	148056	01121	CB3325	2		
R61	Res, comp, 150 ±5%, 1/4W	147934	01121	CB1515	1		
R62, R98	Res, comp, 180 ±5%, 1/4W	147942	01121	CB1815	2		
R73, R116	Res, comp, 750 ±5%, 1/4W	218024	01121	CB7515	2		
R74	Res, comp, 13k ±5%, 1/4W	221598	01121	CB1335	1		
R75	Res, comp, 1m ±5%, 1/4W	182204	01121	CB1055	1		
R84	Res, mf, 13k ±1%, 1/8W	335539	91637	MFF1-81303F	1		
R87	Res, mf, 20k ±1%, 1/8W	291872	91637	MFF1-82002F	1		
R88	Res, comp, 27k ±5%, 1/4W	148148	01121	CB2735	1		

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 7 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R89	Res, mf, 1.3k ±1%, 1/8W	343921	91637	MFF1-81301F	1		
R92	Res, mf, 2.67k ±1%, 1/8W	289587	91637	MFF1-82671F	1		
R93	Res, comp, 6.2m ±5%, 1/4W	221960	01121	CB6255	1		
R97	Res, comp, 220 ±5%, 1/4W	147959	01121	CB2215	1		
R101	Res, comp, 3k, ±5%, 1/4W	193508	01121	CB3025	1		
R103	Res, comp, 100, ±10%, 1/8W	261826	01121	BB1011	1		
R108	Res, comp, 4.7k ±5%, 1/4W	148072	01121	CB4725	1		
R109	Res, comp, 2.4m ±5%, 1/4W	221945	01121	CB2455	1		
R111	Res, comp, 1.6k ±5%, 1/4W	266197	01121	CB1625	1		
R114	Res, comp, 2.4k ±5%, 1/4W	193433	01121	CB2425	1		
T1 thru T4	Coil, xfmr	345850	89536	345850	4		
T5	Xfmr	339234	89536	339234	1		
U1, U18, U25, U30, U44	IC, digital, hi-speed hex inverter	407551	18324	N8T93A	5	1	
U2, U4	IC, digital, hex inverter	352039	01295	SN74L04N	2	1	
U3	IC, digital, quad, 2-input	363580	01295	SN74S00N	1	1	
U5, U17	IC, TTL, triple, 3-input pos and gate	340448	01295	SN74H11N	2	1	
U6, U8, U46	IC, TTL, 50 MHz, decade counter	320754	01295	SN74196N	3	1	
U9, U11, U33, U48	IC, TTL, JK flip-flop AND input	293092	01295	SN74H102	4	1	
U7	IC, TTL, quad, 2-input NAND gate	292961	01295	SN7403N	1	1	

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 8 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U10, U12, U35, U36	IC, TTL, SSI, dual, j-k neg edge, triggered flip-flop	293100	01295	SN74H106N	4	1	
U13, U23, U37	IC, operational amplifier	271502	12040	LM301A	3	1	
U14, U21, U28, U38, U50	IC, TTL, phase frequency detector	320721	04713	MC4044P	5	1	
U15, U22, U24, U29, U42	IC, TTL, MSI, decade counters	293159	01295	SN7490N	5	1	
U16	IC, TTL, quad, 2-input NAND gate	292953	04713	SN7400N	1	1	
U19, U26	IC, linear, 4-quadrant multiplier dbe, bal, mixer	363762	01295	SN76514N	2	1	
U32, U45	IC, digital presettable hi-speed decade binary counter	348250	18324	N8290A	2	1	
U34, U49	IC, TTL, 50 MHz presettable decade and binary counter	320770	01295	SN7419N	2	1	
U39	IC, TTL, dual d-type edge triggered flip-flop	310227	01295	SN7474N	1	1	
XU14, 21, 28, 38, 50	Socket, 14 pin IC	370304	01295	C931402	5		
	Bumper, rubber	358341	35359	SJ5003	3		
	Cable, coaxial	190322	70903	8269	AR		
	Cable, flat	291807	28213	3350	AR		
	Clamp, cable	104406	0638	TA-1SA	1		
	Conn, pcb to cable	295337	75037	3402	1		
	Conn, cover (included with 295337)	295329					

Table 5-3. SIX-DIGIT GENERATOR MODULE (Sheet 9 of 9)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	Frame	390534	89536	390534	1		
	RF Shield, fence for 6010A-4002	405530	89536	405530	1		
	RF Shield, topcover for 6010A-2024	405548	89536	405548	1		
	RF Shield, bottom cover for 6010A-2026	405555	89536	405555	1		

Table 5-4. ATTENUATOR MODULE (Sheet 1 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	ATTENUATOR MODULE ASSEMBLY (6010A-4103)	388066	89536	388066	REF		
	Cover, module inner	323204	89536	323204	1		
	Cover, module outer	426718	89536	426718	1		
	Nameplate	405290	89536	405290	1		
	ATTENUATOR ASSEMBLY PCB (Figure 5-4)	387753	89536	387753	REF		
C1, C2, C4, C5	Cap, ta, 10 μF , $\pm$20%, 20V	330662	56289	196D106X0020-KA1	4		
C3	Cap, ta, 4.7 μF, $\pm$20%, 35V	363721	56289	196D475X0020-PE4	1		
C6 thru C10	Cap, feed thru 2500 pF, gmv	248286	04222	BSF1BB	5		
C11	Cap, elect, 1000 μF -10/+50%, 16V	193896	73445	ET102X016A02	1	1	
CR1, CR6, CR7	Diode, zener $\pm$5%, 10V	246611	04713	1N961B	3	1	
CR3, CR4	Diode, si, 150 mA	203323	07910	1N4448	2	1	
CR5	Diode, zener	113316	07910	1N748	1	1	
J1	RF, cable	406595	89536	406595	1		
J3, J4	Connector, male	207639	98291	51-049-0000	2		
K2, K3	Relay, DPDT	407536	03508	3SAV5-53-4H1	2		
L1 thru L5	Choke, rf, 6 turn	320911	89536	320911	5		
P6	RF cable	416610	89536	416610	1		
R1	Res, comp, 3.6k $\pm$5%, 1/4W	241620	01121	CB3625	1		
R2	Res, comp, 1.6k $\pm$5%, 1/4W	266197	01121	CB1625	1		
R4, R5	Res, comp, 47k $\pm$5%, 1/4W	148163	01121	CB4735	2		

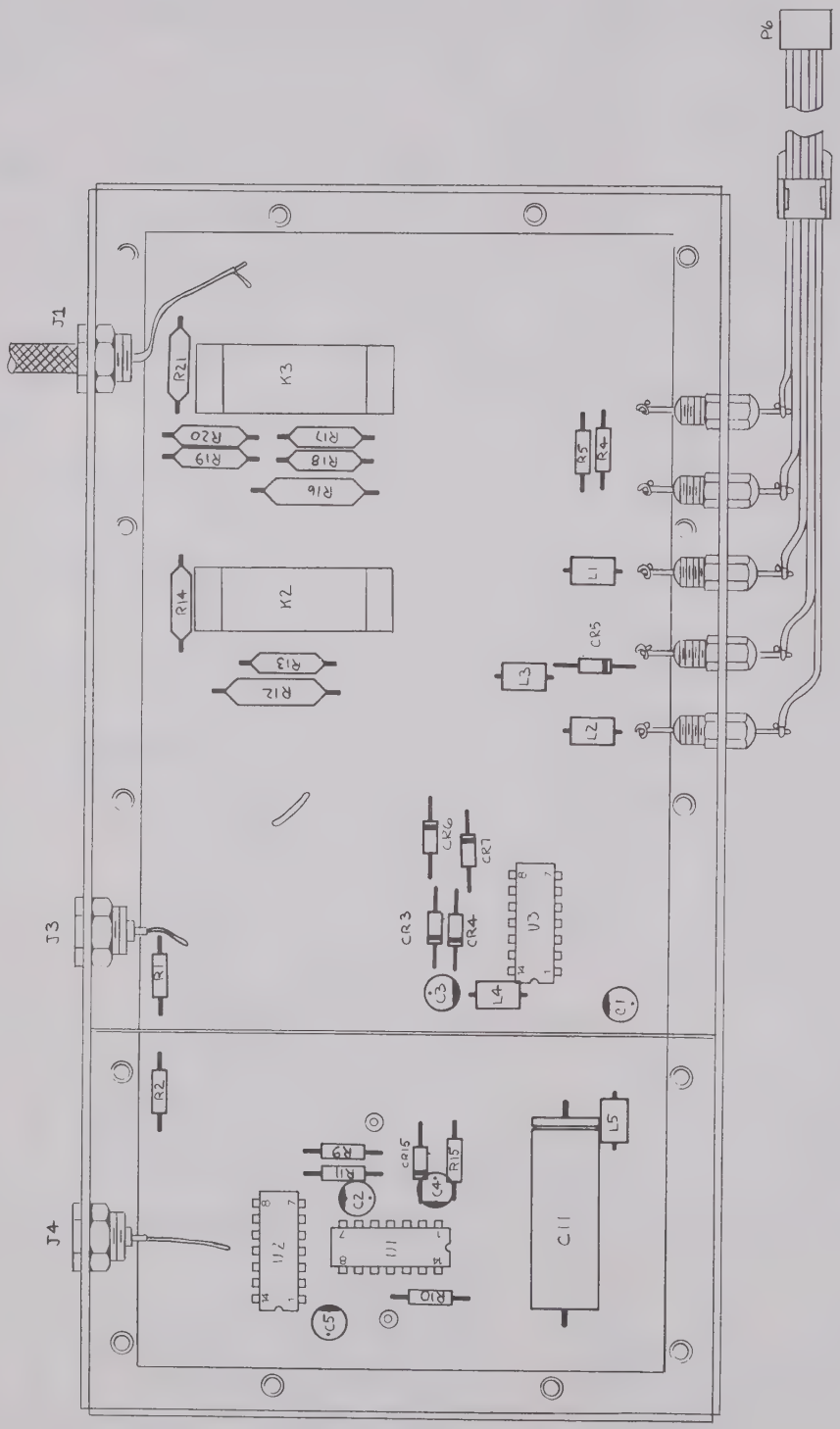


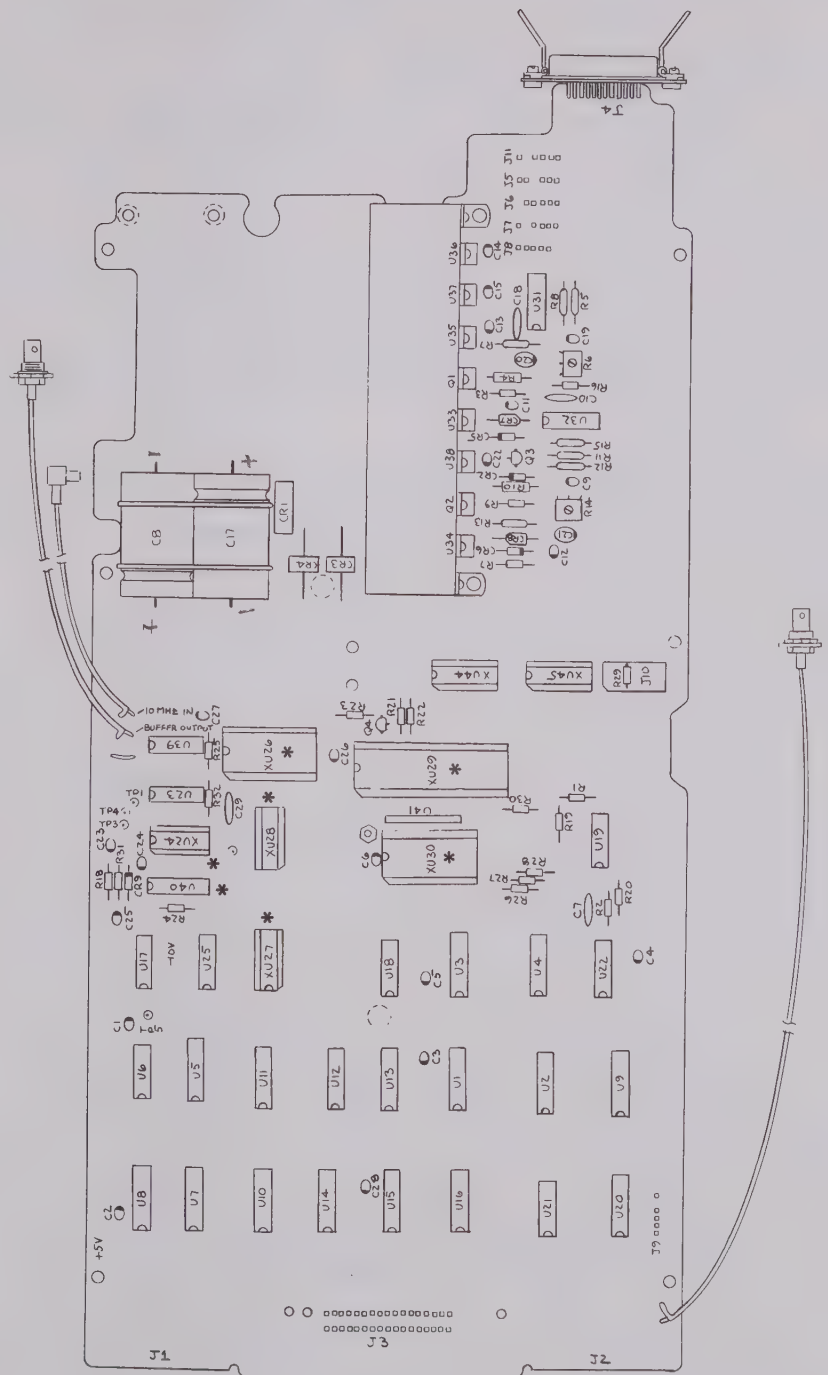
Figure 5-4. ATTENUATOR PCB ASSEMBLY COMPONENT LOCATION (6010A-1603)

Table 5-4. ATTENUATOR MODULE (Sheet 2 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R9	Res, comp, 1.1k ±5%, 1/4W	267336	01121	CB1125	1		
R10, R11	Res, comp, 150k ±5%, 1/4W	182212	01121	CB1545	2		
R12, R16	Res, mf, 61.111 ±0.1%, 1/2W	408435	91637	MFF1-261R111B	2		
R13, R17, R20	Res, mf, 247.5 ±0.1%, 1/4W	408427	91637	MFF1-4247R5B	3		
R14, R18, R19, R21	Res, mf, 61.111 ±0.1%, 1/4W	408419	91637	MFF1-461R111B	4		
R15	Res, comp, 1.3k ±5%, 1/4W	234252	01121	CB1325	1		
U1	IC, linear, hi-speed analog voltage comparator	386920	18324	NE529A	1	1	
U2	IC, digital, quad, 2-input	363580	01295	SN74S00N	1	1	
U3	IC, digital, TTL, buffers and interface gates with open collectors	407593	01295	SN7406N	1	1	
	Cable, RF	416610	89536	416610	1		
	Clamp, cable	104406	06383	TA-1SA	1		
	Fence, RF shield	324939	89536	324939	1		
	Finger stock	334557	30817	97-390	AR		
	Frame, mod	323196	89536	323196	1		
	Spacer	296319	32559	T08-06	8		

Table 5-5. MAIN PCB (Sheet 1 of 4)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	MAIN PCB ASSEMBLY (6010A-4004) (Figure 5-5)	388017	89536	388017	REF		
C1 thru C6, C9, C19, C22, C24, thru C28	Cap, ta 10 μF, ±20%, 20V	330662	56289	196D106X0020-KA1	14		
C7, C10, C18, C29	Cap, cer, 0.0012 μF, ±10%, 500V	106732	71590	CF122	4		
C8, C17	Cap, elect, 2100 pF, -10/+100%, 25V	370742	25088	B41010-4700-25	2	1	
C11, C12	Cap, ta, 6.8 μF ±20%, 35V	363713	56289	196D685X0035-KA1	2		
C13, C14, C15	Cap, ta, 68 μF, ±20%, 15V	193615	56289	196D686X0015-LA3	3		
C20, C21	Cap, ta, 47 μF ±20%, 20V	348516	56289	196D476X0020-TE4	2		
C30	Cap, 0.22 μF, 50V	309849	71590	CW30C224K	1		
C23	Cap, ta, 0.47 μF, ±20%, 35V	161349	56289	196D474X0035-HA1	1		
CR1	Diode, bridge 1000 piv	296509	09423	FB200	1	1	
CR2	Diode, si, multi-pellet	375485	09214	MPD300	1	1	
CR3, CR4	Rectifier, si, semiconductor	325746	04713	MR751	2	1	
CR5, CR6	Diode, zener, 18V	327973	07910	1N967B	2	1	
CR7, CR8 CR10, CR11	Diode, si, 1 amp, 100 piv	116111	05277	1N4817	4	1	
CR9	Diode, si, hi-speed switching	203323	07910	1N4448	1	1	
J3	Connector, amp pins	379438	00779	86144-5	1		
J4	Connector, male	408898	02660	57-20240-2(383)	1		



**This location contains MOS device. Refer to MOS device special handling in Section 4.*

Figure 5-5. MAIN PCB ASSEMBLY COMPONENT LOCATION (6010A-1604)

Table 5-5. MAIN PCB (Sheet 2 of 4)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	Latch	412700	02660	57-1001	2		
	Spring	412718	02660	57-1002-02	2		
Q1, Q2	Xstr, si, PNP	325753	03508	D45C5	2	1	
Q3, Q4	Xstr, Si, PNP	195974	04713	2N3906	2	1	
R1, R19, R20, R23 R30	Res, fxd, comp, 10k ±5%, 1/4W	148106	01121	CB1035	5		
R2, R29	Res, fxd, comp, 100 ±5%, 1/4W	147926	01121	CB1015	2		
R3	Res, fxd, comp, 150 ±5%, 1/4W	147934	01121	CB1515	1		
R4, R10	Res, fxd, comp, 1.2 ±5%, 1/2W	218701	01121	EB12G5	2		
R5	Res, fxd, mf, 3.4k ±1%, 1/8W	260323	91637	MFF1-83401F	1		
R6, R14	Res, var, 500 ±10%, 1/2W	325613	71450	360T501A	2	1	
R7	Res, fxd, mf, 3.57k ±1%, 1/8W	226217	91637	MFF1-83571F	1		
R8	Res, fxd, mf, 1.87k ±1%, 1/8W	267229	91637	MFF1-81871F	1		
R9	Res, fxd, comp, 360 ±5%, 1/4W	340844	01121	CB3615	1		
R11, R12	Res, fxd, mf, 3.01k ±1%, 1/8W	312645	91637	MFF1-83011F	2		
R13	Res, fxd, mf, 5.62k ±1%, 1/8W	235168	91637	MFF1-85621F	1		
R15	Res, fxd, mf, 1.78k ±1%, 1/8W	349092	91637	MFF1-81781F	1		
R16, R17	Res, fxd, comp, 2k ±5%, 1/4W	202879	01121	CB2025	2		
R18	Res, fxd, comp, 680k ±5%, 1/4W	188433	01121	CB6845	1		
R21, R22	Res, fxd, comp, 2.2k ±5%, 1/4W	148049	01121	CB2225	2		
R24	Res, fxd, comp, 47k ±5%, 1/4W	148163	01121	CB4735	1		
R25, R32	Res, fxd, comp, 22k ±5%, 1/4W	148130	01121	CB2235	2		

Table 5-5. MAIN PCB (Sheet 3 of 4)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R26, R27, R28	Res, fxd, comp, 5.6k ±5%, 1/4W	148080	01121	CB5625	3		
R31	Res, fxd, comp, 51 ±5%, 1/4W	221879	01121	CB5105	1		
U1, U2, U3, U4	IC, digital, LPOW, Schottky, data select, multiplex	407577	01295	SN74LS251N	4	1	
U5	IC, digital, TTL, LPOW, Schottky	407585	01295	SN74LS138N	1	1	
U6, U23	IC, digital, TTL, MSI D/CTR	402454	01295	SN74LS90N	2	1	
U7	IC, TTL, MSI, bcd to d/d drvr	293175	01295	SN74145N	1	1	
U8, U10 thru U16, U20	IC, digital, TTL, quad/gate D, F/F	407601	12040	DM86L13N	9	2	
U9	Res, network, 10k ±5%, 1/4W	355305	89536	355305	1	1	
U17	IC, TTL, quad 2-input	393033	01295	SN74LS00N	1	1	
U18, U19	IC, TTL hex inverter	352039	01295	SN74L04N	2	1	
U21	IC, TTL hex inverter/buff drvr	288605	01295	SN7416N	1	1	
U22	IC, digital, LPOW, Schottky	393124	01295	SN74LS74N	1	1	
U24	IC, clock generator ⊗	404459	34649	C4201	1	1	
U25	Res, network, 10k ±5%, 1/4W	355313	89536	355313	1	1	
U26	IC, digital, 4-bit micro-computer ⊗	404418	34649	C4040	1	1	
U27, U28	IC, digital, 4-bit micro-computer RAM ⊗	404442	34649	P4002-1	2	1	
U29	IC, digital, 4-bit micro-computer standard memory interface ⊗	404434	34649	P4289	1	1	
U30	IC, digital, MOS, n-channel ⊗	413724	89536	413724	1	1	
U31, U32	IC, linear,voltage regulator	379420	04713	MCP723C	2	1	
U33	IC, linear, voltage regulator, fixed voltage	407627	04713	MC7808CP	1	1	

Table 5-5. MAIN PCB (Sheet 4 of 4)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U34, U38	IC, linear, negative voltage regulator	407635	04713	MC7908CP	2	1	
U35, U36, U37	IC, linear, voltage regulator, fixed voltage	355107	04713	MC7805CP	3	1	
U39	IC, digital, TTL, hex inverter	293076	01295	SN74H04N	1	1	
U40	IC, digital, CMOS, hex buffer/inverters ⊗	381848	04713	MC14049CP	1	1	
U41	Res, network, 10k ±2%, 1/8W	414003	56289	TYPE200C	1	1	
U44, U45	Res, network, 33 ±5%, 1/4W	413575	56289	TYPE916C	2	1	
XU24, XU27, XU28, XU44, XU45, XJ10	Socket, IC, 16 pin	370312	01295	C931602	6		
XU26, XU30	IC, socket, 24 pin	376236	01295	C932402	2		
XU29	IC, socket, 40 pin	376244	01295	C934002	1		
	Bracket, angle	306225	73734	36-515	2		
	Cable, RFC	406603	89536	406603	1		
	Cable, RFC	406645	89536	406645	1		
	Cable, RFC	406652	89536	406652	1		
	Connector Plate	391052	89536	391052	1		
	Heat Sink	390492	89536	390492	1		
	Strap, rubber component holder	104794	98159	2829-115-3	2		
	Pin, amp	267500	00779	86144-2	30		
	Spacer, pcb	306084	89536	306084	2		
	Socket, xstr	402958	27264	10-18-2031	8		
	⊗ **CAUTION** **Use standard MOS symbol and caution.**						

Table 5-6. DISPLAY ASSEMBLY (Sheet 1 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	DISPLAY ASSEMBLY PCB 6010A-4005 (Figure 5-6)	388033	89536	388033	REF		
C1, C3, C5 thru C8	Cap, ta, 10 μF, $\pm$20%, 20V	330662	56289	196D106X0020-KA1	6		
C2	Cap, mica, 33 pF, $\pm$5%, 500V	160317	71236	DM15E330J	1		
C4, C9	Cap, cer, 0.0012 μF, $\pm$10%, 500V	106732	71590	CF122	2		
CR1 thru CR6, CR9, CR10	Diode, ge, 80 mA, 100 piv	149187	93332	1N270	8	2	
CR7	Diode, si, hi-speed switch	203323	07910	1N4448	1	1	
CR8	Diode, zener	159798	07910	1N751A	1	1	
DS1 thru DS7	LED, display	418392	50579	DL707-811	7		
DS8	LED, display, 7-seg-orange	407874	29083	MAN4610	1		
DS9 thru DS17, DS20	Diode, light emitting	428623	07263	FLV102	10	2	
DS18, DS19	Diode, light emitting	385914	03508	SSL-22	2	1	
P1, P2	Comm, rcotl, bdledge	291922	00779	583650-5	2		
Q1 thru Q7	Xstr, si, PNP	340026	04713	MPS6563	7	2	
Q9	Xstr, J-FET, p-channel 50 mA 30V	413690	17856	J6006	1	1	
R1, R11	Res, mf, 73.2k $\pm$1%, 1/8W	237222	91637	MFF1-87322F	2		
R2, R6, R10, R12	Res, comp, 10k $\pm$5%, 1/4W-	148106	01121	CB1035	4		
R3	Res, comp, 750k $\pm$5%, 1/4W	221937	01121	CB7545	1		
R4	Res, comp, 100k $\pm$5%, 1/4W	148189	01121	CB1045	1		

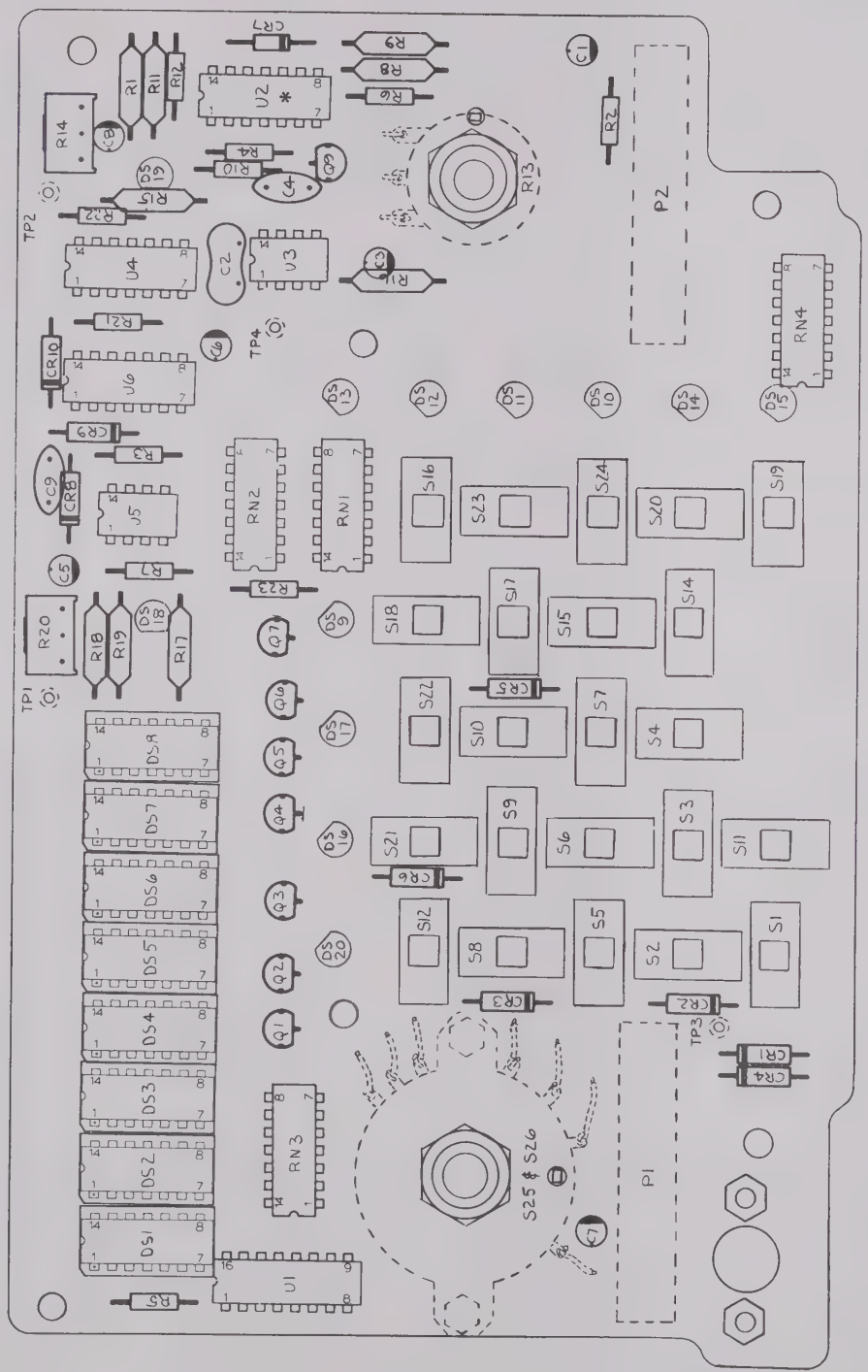


Figure 5-6. DISPLAY PCB ASSEMBLY COMPONENT LOCATION (6010A-1605)

Table 5-6. DISPLAY ASSEMBLY (Sheet 2 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R5	Res, comp, 47 ±5%, 1/4W	147892	01121	CB4705	1		
R7, R23	Res, comp, 330 ±5%, 1/4W	147967	01121	CB3315	2		
R8	Res, mf, 604 ±1%, 1/8W	320309	91637	MFF1-86040F	1		
R9	Res, mf, 52.3k ±1%, 1/8W	237248	91637	MFF1-85232F	1		
R13	Res, var, cer, 50k ±5%, 2W	408187	89536	408187	1	1	
R14	Res, var, cermet, 1k ±10%, 1/2W	285155	71450	360S102A	1	1	
R15	Res, mf, 1.82k ±1%, 1/8W	293670	91637	MFF1-81821F	1		
R16	Res, mf, 27.4k ±1%, 1/8W	241471	91637	MFF1-82742F	1		
R17	Res, mf, 4.99k ±1%, 1/8W	168252	91637	MFF1-84991F	1		
R18	Res, mf, 402 ±1%, 1/8W	289611	91637	MFF1-84020F	1		
R19	Res, mf, 7.87k ±1%, 1/8W	294934	91637	MFF1-87871F	1		
R20	Res, var cermet, 2k ±10%, 1/2W	285163	71450	360S-202A	1		
R21	Res, comp, 51k ±5%, 1/4W	193334	01121	CB5135	1		
R22	Res, comp, 300 ±5%, 1/4W	348276	01121	CB3015	1		
RN1	Res, network, 130 ±5%, 1/4W	381616	89536	381616	1		
RN2	Res, network, 6k ±5%, 1/4W	355131	89536	355131	1		
RN3	Res, network, 82 ±5%, 1/4W	379008	89536	379008	1		
RN4	Res, network, 47 ±5%, 1/4W	402636	89536	402636	1		
S1 thru S11	Switch, assy, pushbutton, white	406744	89536	406744	11		
S12, S18, S21, S22	Switch, assy, pushbutton, light grey	401307	89536	401307	4		
S14, S15, S17, S19, S20, S23, S24	Switch, assy, pushbutton, dark grey	406728	89536	406728	7		

Table 5-6. DISPLAY ASSEMBLY (Sheet 3 of 3)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
S16	Switch, assy, pushbutton, light blue	406736	89536	406736	1		
S25, S26	Switch, rotary	408260	89536	408260	2		
U1	IC, TTL, bcd to seven seg, decode/driv	340109	01295	SN7447AN	1	1	
U2	IC, digital, CMOS, quad, bilateral switch ⊗	363838	31019	SCL4016AE	1	1	
U3,U5	IC, linear, op amp	363515	12040	LM301AN	2	1	
U4	IC, TTL, hex inverter, buff/driv	288605	01295	SN7416N	1	1	
U6	IC, TTL, monostable/multivibrators	293050	01295	SN74121N	1	1	
XDS1 thru DS8	Socket, IC 14 pin	418723	01295	C-921400	8		
	Switch, p/b, SPST, 10 mA, 5V dc	414516	89536	414516	23		
	Switch, p/b, SPST, 10 mA, 5V dc	416875	89536	416875	23		
	Cover, switch	401299	89536	401299	23		
	Actuator, switch	412106	89536	412106	23		
	⊗ **CAUTION** **Use standard MOS symbol and caution.**						

Section 6

Option & Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains the information necessary to install, operate and maintain the options and/or accessories which are available for use with the Model 6010A Synthesized Signal Generator. The information provided is divided into subsections, with each option comprising a subsection and the accessories as a whole, comprising a subsection. The location of a particular subsection is facilitated by the use of unique page and paragraph numbering which corresponds to the option or accessories in question. For example, a 600-x series identifies the Accessories subsection and a 605-x series identifies the subsection for the —05 Option (where x is sequential page or paragraph numbers). The available options are identified in the following table of contents. Replaceable parts are listed in table form with each option. Also, component location and schematic diagrams are provided in figure form with each option.

OPTION/ MODEL NO.	DESCRIPTION	PAGE NO.
	ACCESSORIES	
	Rack Mounting, 5-1/4 Inch Instrument	600-1
	OPTIONS	
—01	High Performance TCXO	601-1
—02	Phase Lock Input	602-1
—03	Frequency Modulation	603-1
—04	Rear Panel Output	604-1
—05	IEEE-488 General Purpose Bus Interface	605-1
—06	EIA Standard RS-232C Interface	606-1
—07	50-400 Hz Line Power	607-1
—08	100V, 50-60 Hz Line Power	608-1
—09	20-31 MHz Tracking Output	609-1
—10	75Ω Output Impedance	610-1

Option 600-1
Accessories

600-1. ACCESSORIES

600-2. The accessories available for use with the Model 6010A Synthesized Signal Generator are discussed in the following paragraph.

600-3. RACK MOUNTING 5¼ INCH INSTRUMENT

600-4. Rack mounting kits are available for use with the 6010A that will provide left or right offset, center or side-by-side installation in a standard 19 inch equipment rack. Instructions for attaching the rack mounts to the instrument are provided with each kit. The model number for each kit is listed in Table 1-1. When ordering these kits please identify them by model number and description.

Option —01
High Performance TCXO

601-1. —01 OPTION, HIGH PERFORMANCE TCXO

601-2. Introduction

601-3. The high performance oscillator is a non-repairable assembly that mounts in the same location as the standard oscillator. This 10 MHz temperature compensated oscillator has a rated stability of ±1.5 parts in 10^6 per year with temperature dependence of less than ±5 parts in 10^7 from 0°C to +50°C. The —01 option must be installed at the factory at the time the 6010A is purchased.

601-4. CALIBRATION

601-5. Calibration of the 6010A equipped with the —01 option is the same as that of the standard unit. See Section 4 for the calibration procedures.

Option —02
Phase Lock Input

602-1. —02 OPTION, PHASE LOCKED INPUT

602-2. Introduction

602-3. The Phase Locked Input option allows the 6010A to use frequency standard inputs that are subharmonics of 10 MHz. The internal 10 MHz oscillator will phase lock to the external frequency standard provided the frequency is within 4 parts in 10^6 of the 10 MHz internal oscillator frequency. The 6010A output frequency accuracy and frequency stability are related to the external reference applied to the Phase Locked Input option.

602-4. Theory of Operation

602-5. The Phase Locked Input option is illustrated in block diagram form in Figure 602-1. The schematic diagram located in Figure 602-2 provides complete details of the circuit.

602-6. An external reference applied to the EXT REF connector on the rear panel of the 6010A is routed to J1 on the Phase Locked Input module. The reference signal is first converted to a TTL compatible signal then applied to a phase detector. The phase detector compares the TTL input with the output of the TC/VCXO. A difference in phase causes the amplifier to output a control voltage to the voltage controlled oscillator. A signal detector circuit will, when an external reference is applied to J1, close the switch to connect the amplifier to the voltage control input of the oscillator. The control voltage causes the oscillator to change frequency to match that of the applied external reference frequency.

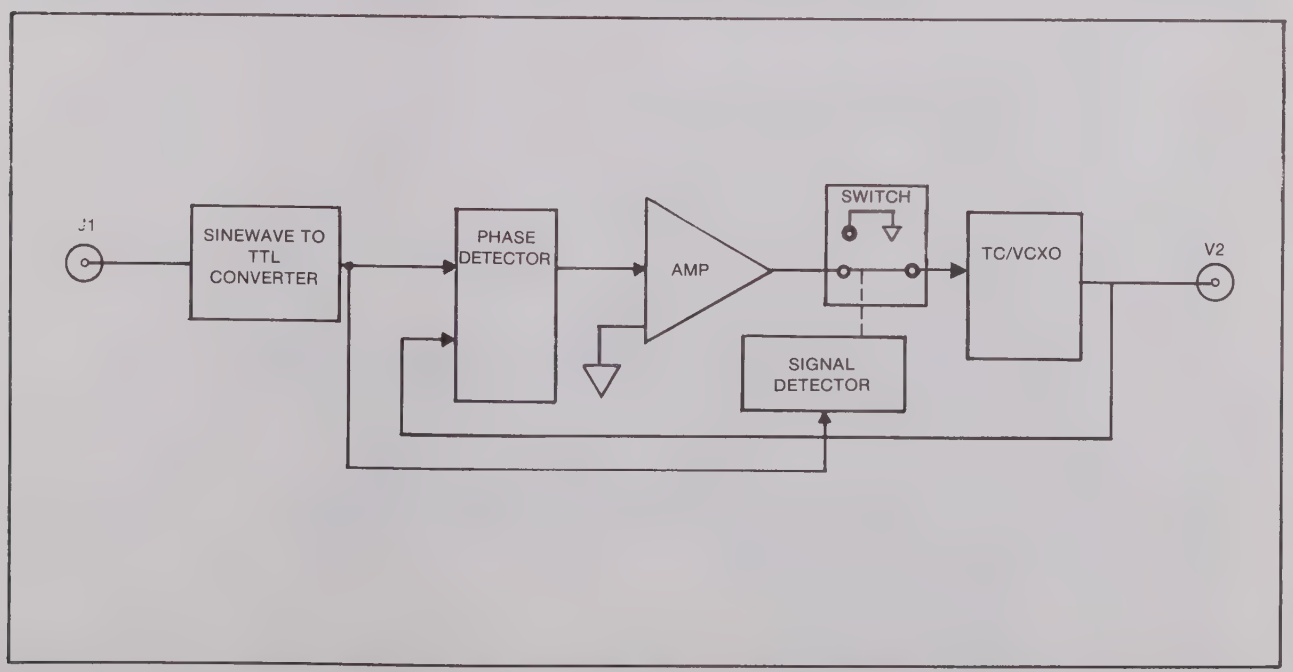


Figure 602-1. PHASE LOCKED INPUT OPTION BLOCK DIAGRAM

602-7. Troubleshooting

602-8. Most malfunctions in the Phase Locked Input module are likely to result in one of two inoperable conditions. The 10 MHz output will not phase lock to the external reference signal or the module has no output at all. Observing the output of the module at J2 with an oscilloscope should determine its operating condition.

602-9. The following procedure will check the operation of the Phase Locked Input module.

1. Unplug the 6010A power cord and remove the top dust cover.

2. Swing the Six Digit Generator module out for access to the Phase Locked Input module (see Maintenance Access Section 4).

3. Remove the four mounting screws from the sides of the Phase Locked Input module and lift it out of the chassis.

4. Remove the top cover of the Phase Locked Input module.

5. Place some insulating material between the removed module and the top of the 6010A chassis to set the module on.

6. Plug the 6010A in and turn it on.

7. Connect the frequency counter to the signal lead connecting the pcb to J2. The signal should be 10 MHz ±1 Hz (adjust Y1 cal. adjust if needed).

8. Connect the signal generator, set for 10 MHz at +13 dBm, to the EXT REF input on the 6010A rear panel.

9. Vary the signal generator output frequency ±40 Hz. Check the counter for a corresponding change in frequency at J2.

10. Remove the signal generator input from the rear panel connector.

602-10. The two probable operating conditions are listed in Table 602-1 followed by some procedural steps that will aid in isolating the malfunction.

602-11. —02 Option, List of Replaceable Parts

602-12. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the —02 option is provided in Table 602-2.

Table 602-1. PHASE LOCKED INPUT MODULE TROUBLESHOOTING

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
	NO SIGNAL AT J2.		
1	Is the 10 MHz signal present at U6 pin 1?	2	3
2	Replace U6.		
3	Is dc power at Y1 pin 3 approximately +1.4V?	4	5
4	Replace Y1.		
5	Troubleshoot power supplies on main pcb.		
	J2 SIGNAL WON'T PHASE LOCK TO INPUT		
6	Check voltage at TP2; should be 0 volts ±0.01V when 10 MHz ±1 Hz is applied to EXT REF input. With 10 MHz +30 Hz applied, TP2 voltage should be −2.4 to −4 volts. With 10 MHz−30 Hz applied, TP2 voltage should be +2.4 to +4 volts. Are these voltages correct?	7	8
7	Replace Y1.		
8	Does the voltage remain at zero when the input frequency is changed?	9	12
9	Check for voltage changes at junction of R18 and R19 when frequency is changed. Are voltages correct?	10	11
10	Check operation of U4 and U5.		
11	Check U3, Q3 and Q4.		
12	Check U2, U3, Q3 and Q4.		

Option —02
Phase Lock Input

602-1. —02 OPTION, PHASE LOCKED INPUT

602-2. Introduction

602-3. The Phase Locked Input option allows the 6010A to use frequency standard inputs that are subharmonics of 10 MHz. The internal 10 MHz oscillator will phase lock to the external frequency standard provided the frequency is within 4 parts in 10^6 of the 10 MHz internal oscillator frequency. The 6010A output frequency accuracy and frequency stability are related to the external reference applied to the Phase Locked Input option.

602-4. Theory of Operation

602-5. The Phase Locked Input option is illustrated in block diagram form in Figure 602-1. The schematic diagram located in Figure 602-2 provides complete details of the circuit.

602-6. An external reference applied to the EXT REF connector on the rear panel of the 6010A is routed to J1 on the Phase Locked Input module. The reference signal is first converted to a TTL compatible signal then applied to a phase detector. The phase detector compares the TTL input with the output of the TC/VCXO. A difference in phase causes the amplifier to output a control voltage to the voltage controlled oscillator. A signal detector circuit will, when an external reference is applied to J1, close the switch to connect the amplifier to the voltage control input of the oscillator. The control voltage causes the oscillator to change frequency to match that of the applied external reference frequency.

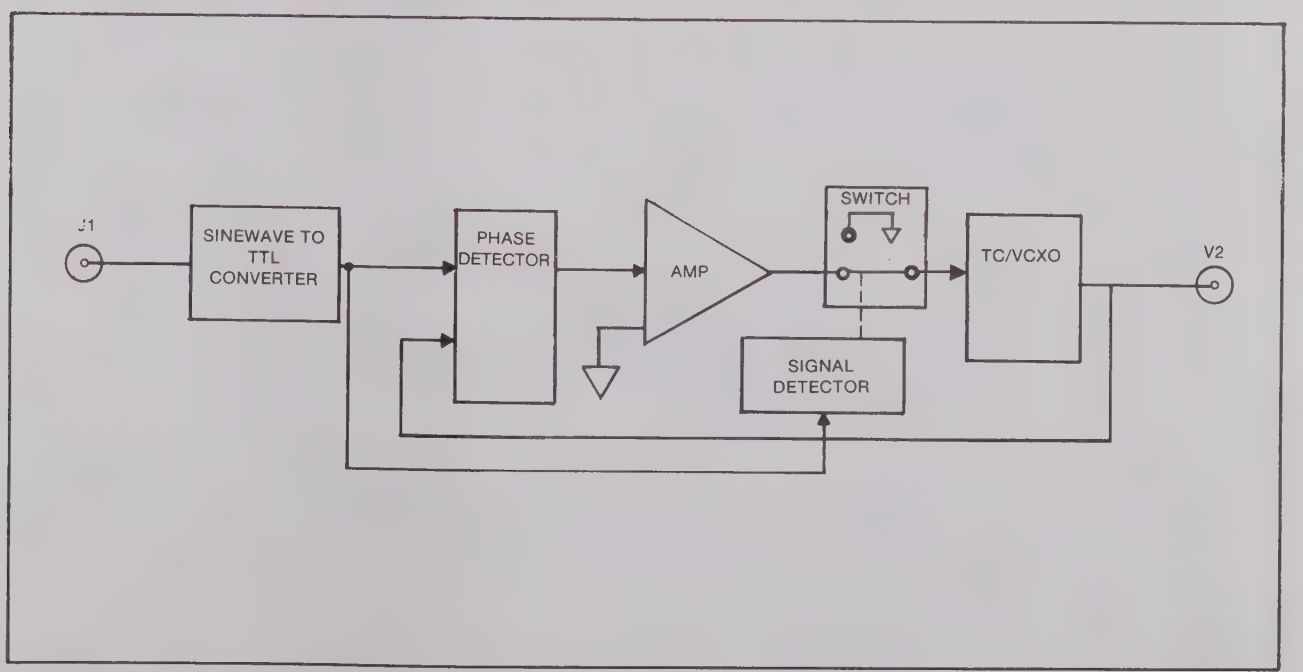


Figure 602-1. PHASE LOCKED INPUT OPTION BLOCK DIAGRAM

602-7. Troubleshooting

602-8. Most malfunctions in the Phase Locked Input module are likely to result in one of two inoperable conditions. The 10 MHz output will not phase lock to the external reference signal or the module has no output at all. Observing the output of the module at J2 with an oscilloscope should determine its operating condition.

602-9. The following procedure will check the operation of the Phase Locked Input module.

1. Unplug the 6010A power cord and remove the top dust cover.
2. Swing the Six Digit Generator module out for access to the Phase Locked Input module (see Maintenance Access Section 4).
3. Remove the four mounting screws from the sides of the Phase Locked Input module and lift it out of the chassis.
4. Remove the top cover of the Phase Locked Input module.
5. Place some insulating material between the removed module and the top of the 6010A chassis to set the module on.
6. Plug the 6010A in and turn it on.
7. Connect the frequency counter to the signal lead connecting the pcb to J2. The signal should be 10 MHz ±1 Hz (adjust Y1 cal. adjust if needed).
8. Connect the signal generator, set for 10 MHz at +13 dBm, to the EXT REF input on the 6010A rear panel.
9. Vary the signal generator output frequency ±40Hz. Check the counter for a corresponding change in frequency at J2.
10. Remove the signal generator input from the rear panel connector.

602-10. The two probable operating conditions are listed in Table 602-1 followed by some procedural steps that will aid in isolating the malfunction.

602-11. —02 Option, List of Replaceable Parts

602-12. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the —02 option is provided in Table 602-2.

Table 602-1. PHASE LOCKED INPUT MODULE TROUBLESHOOTING

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
	NO SIGNAL AT J2.		
1	Is the 10 MHz signal present at U6 pin 1?	2	3
2	Replace U6.		
3	Is dc power at Y1 pin 3 approximately +1.4V?	4	5
4	Replace Y1.		
5	Troubleshoot power supplies on main pcb.		
	J2 SIGNAL WON'T PHASE LOCK TO INPUT		
6	Check voltage at TP2; should be 0 volts ±0.01V when 10 MHz ±1 Hz is applied to EXT REF input. With 10 MHz +30 Hz applied, TP2 voltage should be -2.4 to -4 volts. With 10 MHz—30 Hz applied, TP2 voltage should be +2.4 to +4 volts. Are these voltages correct?	7	8
7	Replace Y1.		
8	Does the voltage remain at zero when the input frequency is changed?	9	12
9	Check for voltage changes at junction of R18 and R19 when frequency is changed. Are voltages correct?	10	11
10	Check operation of U4 and U5.		
11	Check U3, Q3 and Q4.		
12	Check U2, U3, Q3 and Q4.		

Table 602-2. PHASE LOCKED INPUT MODULE (Sheet 1 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	PHASE LOCKED INPUT MODULE	410530	89536	410530	1		
	Cover, Module, inner	323204	89536	323204	1		
	Cover, Module, outer	323212	89536	323212	1		
	Nameplate	405282	89536	405282	1		
	Phase Locked Input PCB Assembly (Figures 602-2 and 602-3)	391011	89536	391011	1		
C1, C2, C3, C12, C16	Cap, cer, 0.05 μF -20/+80%, 25V	148924	32897	5855-Y5U-503Z	5		
C4, C6, C8	Cap, feed thru	248286	32897	2499-003X50-252AA	3		
C5, C7, C9, C10, C11, C20, C21	Cap, Ta, 10 μF $\pm$20%, 20V	330662	56289	196D106X0020 KA1	7		
C13, C15	Cap, plstc, 0.047 $\pm$	106054	56289	192P47202	2		
C14	Cap, mica, 33 pF $\pm$5%, 500V	160317	71236	DM15E330J	1		
C17, C18, C19	Cap, cer, 0.01 μF $\pm$20%, 100V	149153	56289	C023B101F103M	3		
CR1 thru CR6	Diode, si, hi-speed switch	203323	07910	1N4448	6	2	
J1, J2	Conn, male, coaxial	207639	98291	51-049-0000	2		
L1 thru L5	Choke, 6-turn	320911	98536	320911	5		
Q1, Q3, Q4	Xstr, si, PNP	229898	04712	MPS6522	3	1	
Q2	Xstr, si, NPN	218081	04713	MPS6520	1	1	
R1	Res, fxd, comp, 51 $\pm$5%, 1/4 W	221879	01121	CB5105	1		
R2, R13	Res, fxd, comp, 270 $\pm$5%, 1/4 W	160804	01121	CB2715	2		
R3, R12, R21	Res, fxd, comp, 10k $\pm$5%, 1/4 W	148106	01121	CB1035	3		
R4, R10, R11	Res, fxd, comp, 47 $\pm$5%, 1/4 W	147892	01121	CB4705	3		

Table 602-2. PHASE LOCKED INPUT MODULE (Sheet 2 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
R5, R6	Res, fxd, comp, 4.7k ±5%, 1/4 W	148072	01121	CB4725	2		
R7, R18	Res, fxd, comp, 330 ±5%, 1/4 W	147967	01121	CB3315	2		
R8, R9, R22	Res, fxd, comp, 47k ±5%, 1/4 W	148163	01121	CB4735	3		
R14, R16	Res, fxd, comp, 33 ±5%, 1/4 W	175034	01121	CB3305	2		
R15	Res, fxd, comp, 6.8k ±5%, 1/4 W	148098	01121	CB6825	1		
R17	Res, fxd, mf, 255k ±1%, 1/8 W	221630	91637	MFF1-82553F	1		
R19	Res, fxd, comp, 1.8k ±5%, 1/4 W	175042	01124	CB1825	1		
R20	Res, fxd, comp, 2.2k ±5%, 1/4 W	148049	01121	CB2225	1		
U1	IC, linear, hi-speed analog voltage comparator	386920	18324	NE529A	1	1	
U2	IC, TTL, dual d type edge triggered flip-flop	320804	01295	SN74H74N	1	1	
U3	IC, operational amplifier	271502	12040	LM301A	1	1	
U4	IC, digital, CMOS, NOR gates	355172	95303	CD4001	1	1	
U5	IC, digital, quad, bilaterial switch	363838	31019	SCL4016AE	1	1	
U6	IC, TTL, quad, 2-input pos NAND buffers	296228	01295	SN7437N	1	1	
	Cable, dc power	419440	89536	419440	1		
	Cable, clamp	104406	06383	TA-1S8	1		
	Module Frame, inner	323196	89536	323196	1		
	Snapbutton	170118	83330	652	2		
	Socket, spring type	386144	00779	3-332070-4	6		

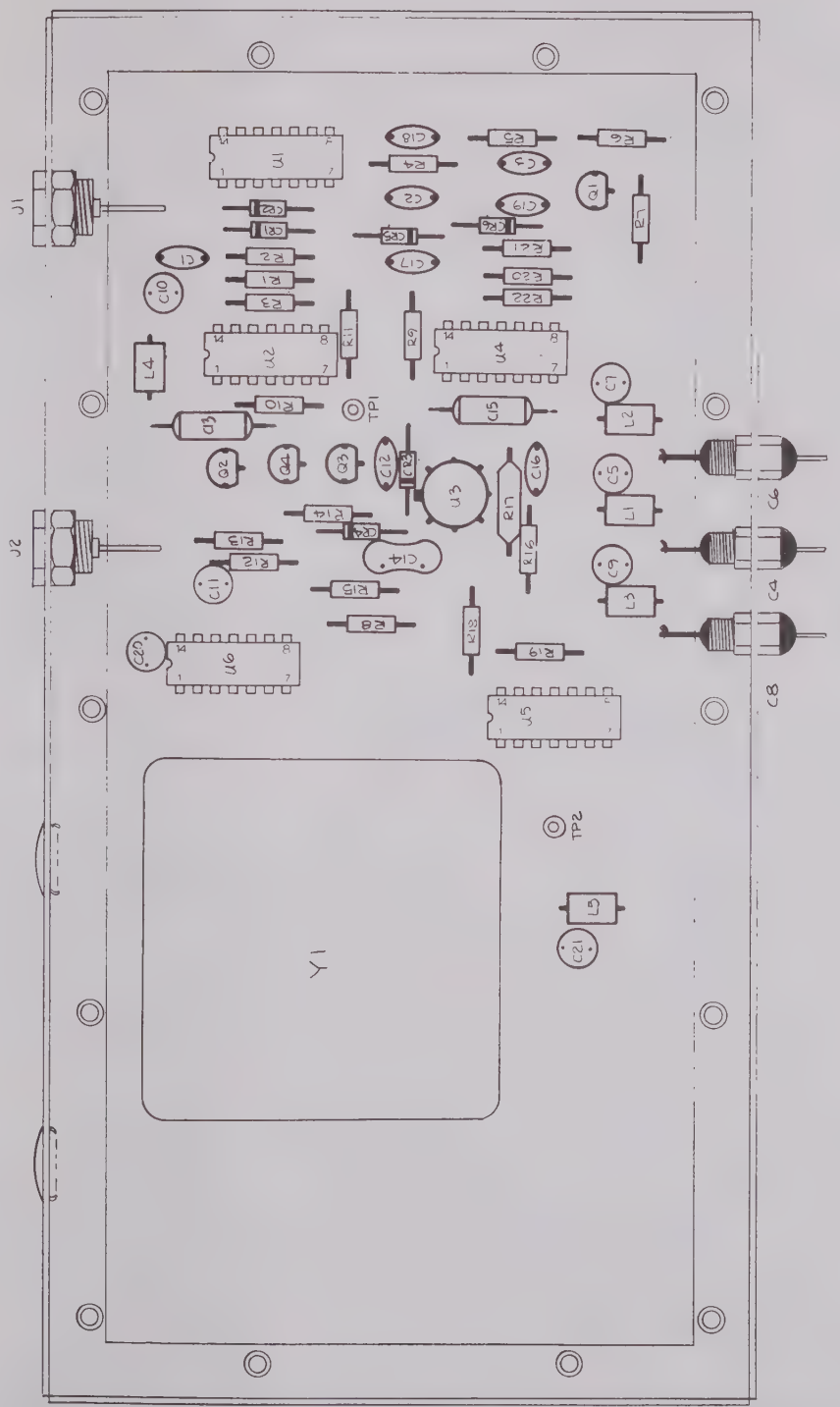


Figure 602-2. PHASE LOCKED INPUT OPTION COMPONENT LOCATION (6010A-1606)

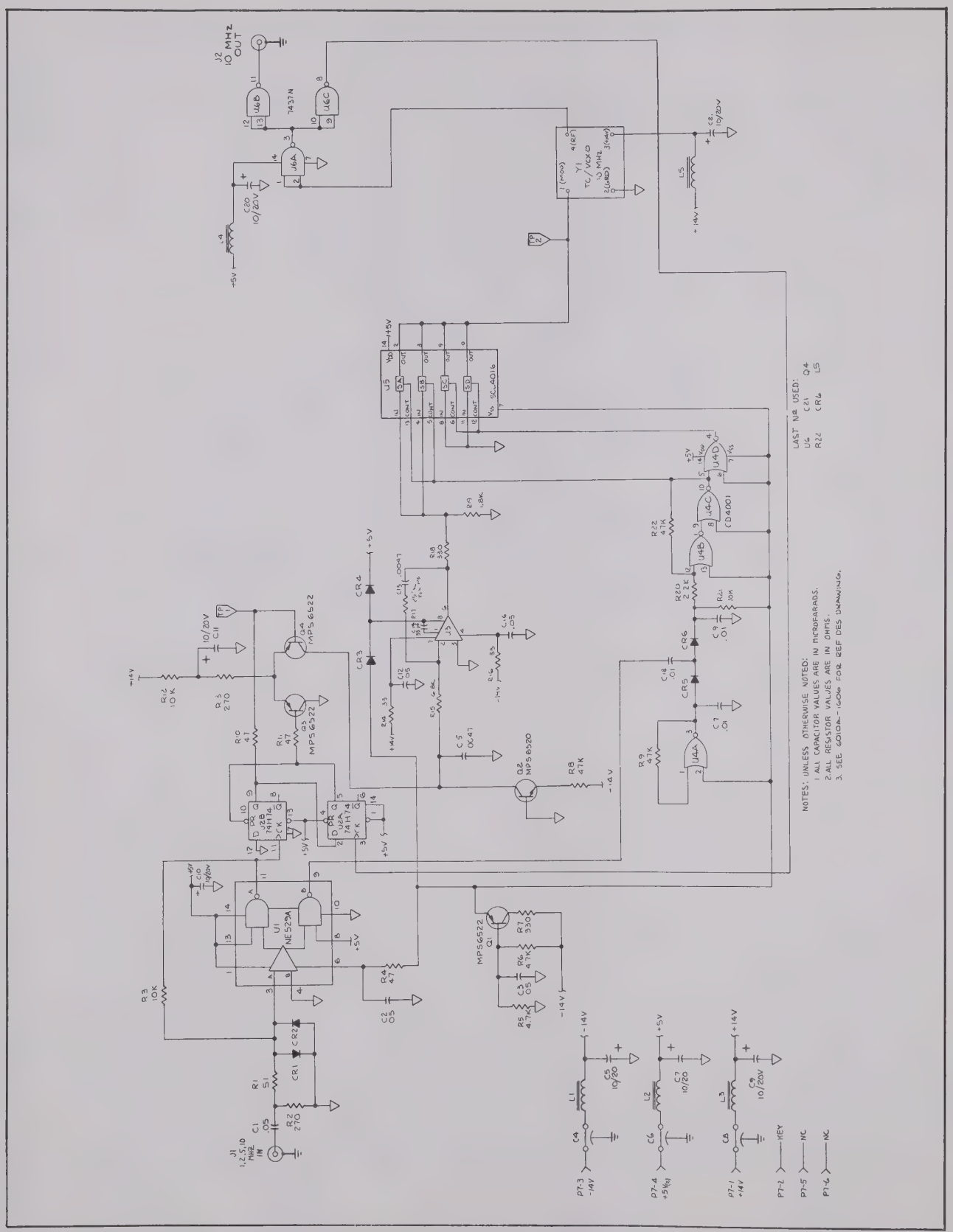


Figure 602-3. PHASE LOCKED INPUT OPTION SCHEMATIC (6010A-1006)

Option —03
Frequency Modulation

603-1. —03 OPTION, FREQUENCY MODULATION

603-2. Introduction

603-3. The Frequency Modulation option provides control of frequency deviation about a selected frequency of up to ±20 kHz (high range) and ±200 Hz (low range). ±5V corresponds to ±20 kHz deviation on the high range and ±200 Hz on the low range. The rate of modulation is controlled by the frequency of the control signal (dc to 10 kHz). Frequency modulation is selected by a front panel push button when operating in local control or by program code when operating the unit remotely.

603-4. Theory of Operation

603-5. The control voltage applied to the FM IN connector is applied to the input of a unity gain buffer amplifier U3. (See FM Oscillator schematic.) The output of U3 is connected to the voltage control input of the FM voltage controlled oscillator, Y1. Changes in the input voltage cause the output frequency of the oscillator to change. The oscillator is then shaped by U1 and U2 into a TTL compatible rf output signal.

603-6. Installation

603-7. Use the following procedure to install the —03 option in the 6010A. Refer to Figure 603-1 for the location of items referenced in the procedure:

1. Remove the top cover from the 6010A.

2. Swing the Input/Output module out. (Remove six screws "A" and loosen two screws "B".)

3. If the Phase Lock option is installed, remove the rf cables and four mounting screws and lay the module back on top of the Attenuator module.

4. Secure the bnc connector on the 21 inch cable (item 4) into the 6010A rear panel opening marked FM IN and lay the cable along the Main PCB toward the front of the 6010A.

5. Plug one end of the 29 inch con-hex to con-hex cable (item 3) into J4 on the Input/Output module. Place the cable into the cable retainers on the cover of the Input/Output module then along the Main PCB toward the front of the 6010A.

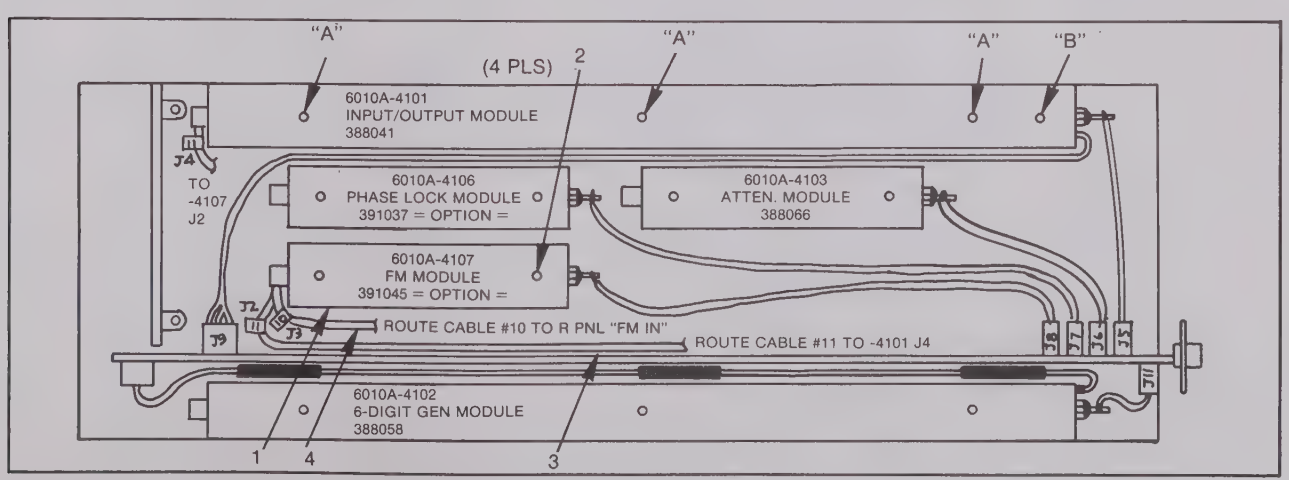


Figure 603-1. FM MODULE INSTALLATION

6. Lower the FM module (item 1) into the 6010A chassis.

7. Route the module power cable under the Attenuator module to the back of the Main PCB and plug it into J8.

h. Plug the rf cable, connected to the FM IN jack, into J3 on the FM module. Plug the rf cable, connected to J4 on the Input/Output module, into J2 on the FM module.

9. Secure the FM module in place with the four screws (item 2) provided.

10. Replace the Phase Locked Input module (if installed), Input/Output module, and top cover.

603-8. Troubleshooting

603-9. The FM Oscillator module must be lifted from the chassis and the module's top cover removed to gain access to the circuitry. The following procedure will prepare the module for troubleshooting.

1. Unplug the 6010A from line power and remove the top dust cover.

2. Swing the Six Digit Generator module out to access the internal modules.

3. Remove the four screws holding the Phase Locked Input module in place and move it to one side (if this option is installed).

4. Remove the four screws holding the FM Oscillator module in place and lift it free of the 6010A chassis.

5. Remove the top cover of the module and place some insulating material between the module and the chassis to set it on.

6. Connect the 6010A to line power and turn it on.

603-10. The step-by-step procedure provided in Table 603-1 will aid in isolating a malfunction in the FM Oscillator module. The steps that require a decision as to proper or improper test results will indicate the next step to proceed to for a yes or no answer.

603-11. —03 Option, List of Replaceable Parts

603-12. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the —03 option is provided in Table 603-2.

Table 603-1. FM OSCILLATOR TROUBLESHOOTING

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
1	Connect a frequency counter to signal lead at RF OUT J2. Short the FM IN signal to ground. Is the frequency of RF OUT 10.000000 MHz ±10 counts (adjust trimmer on oscillator Y1 if needed)?	2	3
2	No problem indicated by this test.		
3	Connect the frequency counter to U1 pin 1. Does the counter indicate 10.000000 MHz ±10 counts?	4	5
4	Check for failure of either U1 or U2.		
5	The VCXO is probably faulty.		

Table 603-2. FM OSCILLATOR MODULE

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FM OSCILLATOR MODULE ASSEMBLY	410548	89536	410548	REF		
	Cover, Module, inner	323204	89536	323204	1		
	Cover, Module, outer	323212	89536	323212	1		
	Nameplate	405274	89536	405274	1		
	FM Oscillator PCB Assembly (Figures 603-2 and 603-3)	391029	89536	391029	REF		
C1, C2, C3, C6, C8, C9	Cap, Ta, 2.2 μF $\pm$20%, 20V	161927	56289	196D225X0020 HA1	6		
C7	Cap, cer, 300 pF $\pm$10%, 500V	105734	71590	BB60301KW7W	1		
C11 thru C15	Cap, feed thru	248286	32897	2499-003X50-252AA	5		
L1 thru L5	Choke, 6-turn	320911	89536	320911	5		
P8	Cable, rf	419432	89536	419432	1		
R1	Res, mf, 604 $\pm$1%, 1/2 W	177154	91637	MFF1-26040F	1		
R3	Res, comp, 4.7k $\pm$5%, 1/4 W	148072	01121	CB4725	1		
R7	Res, comp, 100 $\pm$5%, 1/4 W	193185	01121	CB1015	1		
U1	IC, TTL, quad, 2-input	393033	01295	SN74LS00N	1	1	
U2	IC, TTL, quad, 2-input	293068	01295	SN74H00N	1	1	
	Cable, clamp,	104406	06383	TA-1SA	1		
	Conn, male	207639	98291	51-049-0000	2		
	Module Frame, inner	323196	89536	323196	1		
	Oscillator, 10 MHz voltage controlled crystal	447581	27802	271-2996	1		
	Bus wire, sleeved, No. 22	375170	89536	375170	0.2 ft.		

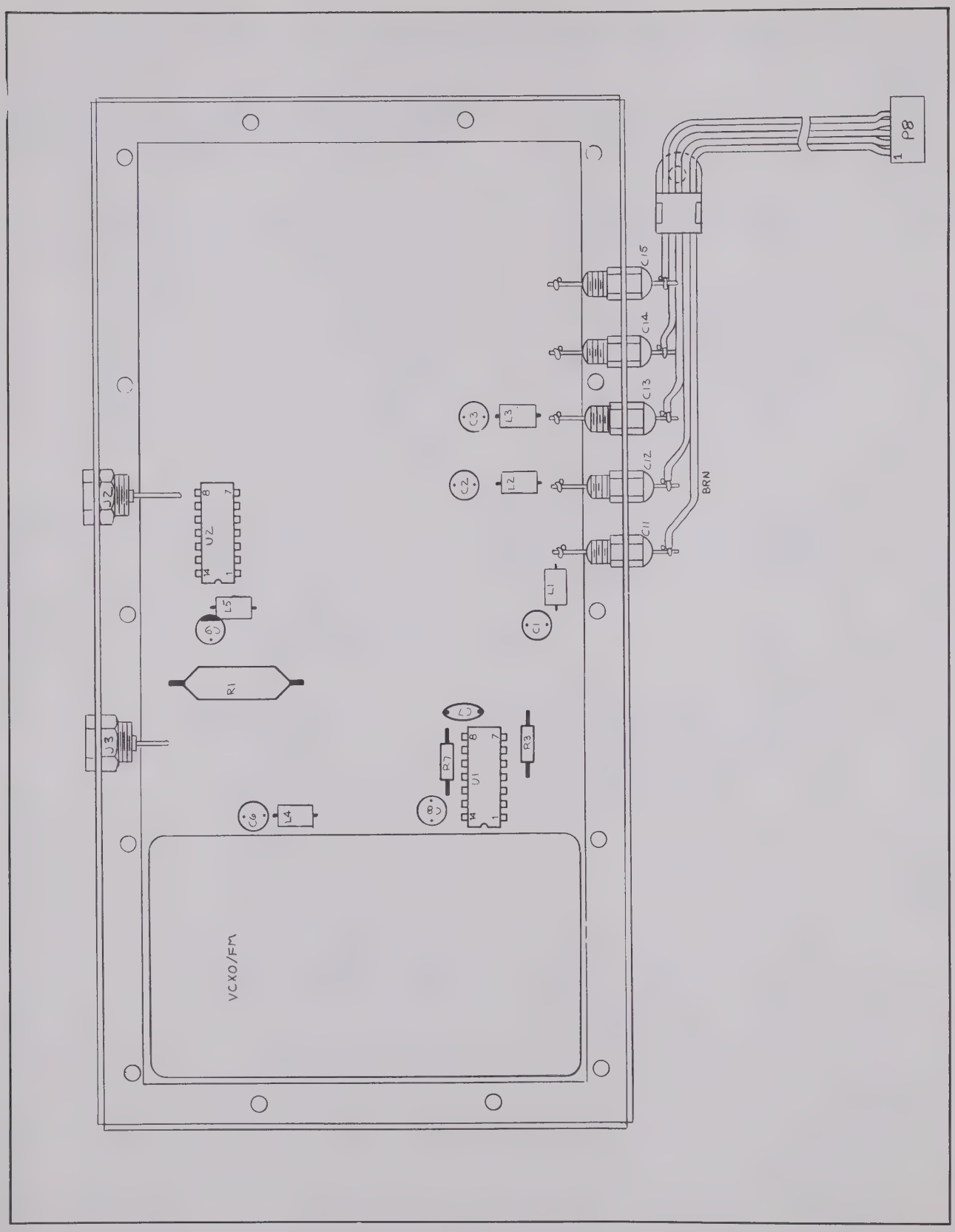


Figure 603-2. FM OPTION COMPONENT LOCATION (6010A-1607)

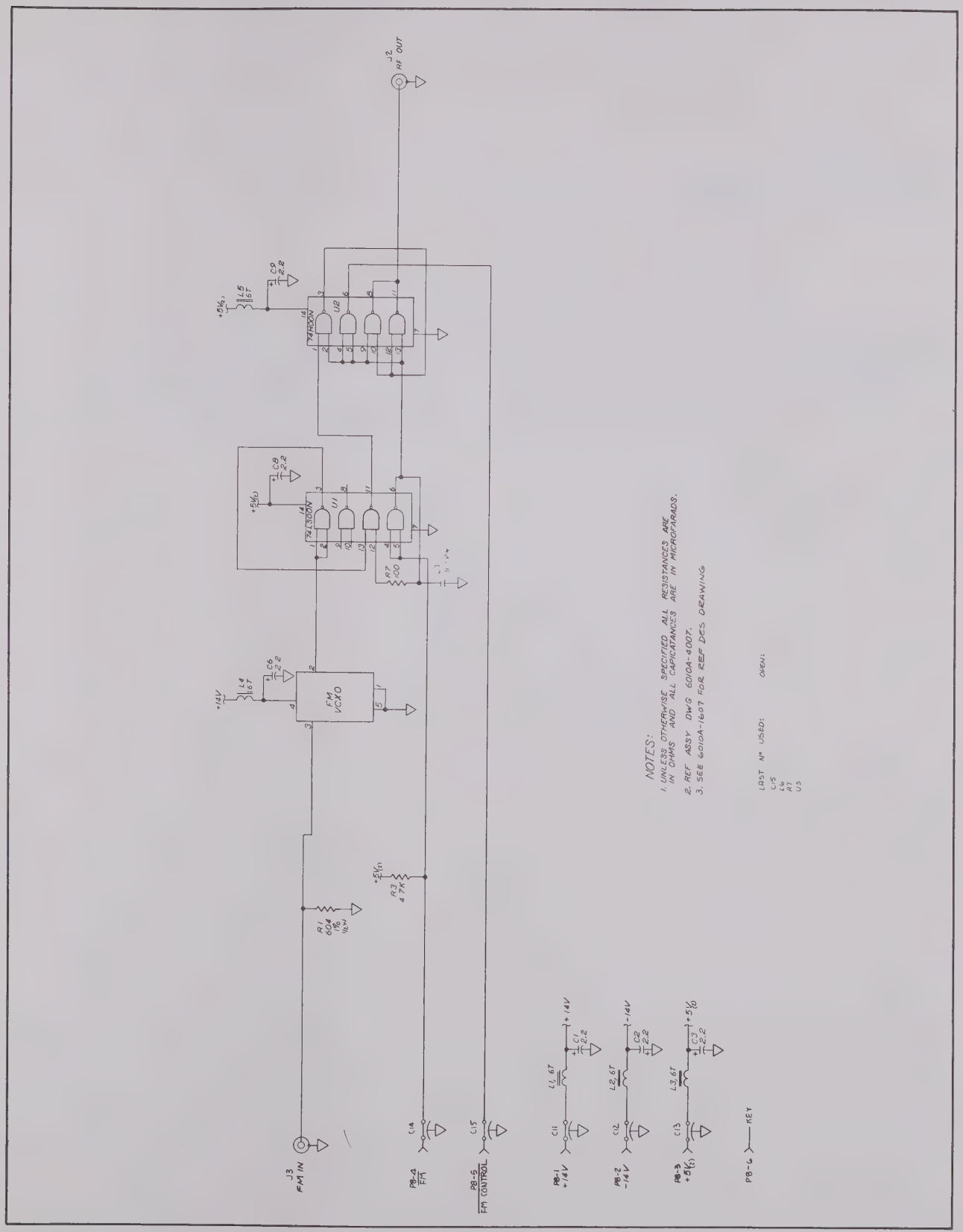


Figure 603-3. FM OPTION SCHEMATIC (6010A-1007)

Option —04
Rear Panel Output

604-1. —04 OPTION, REAR PANEL OUTPUT

604-2. The 6010A output is available at the rear panel when equipped with the —04 option. The specifications for the instrument equipped with the —04 option are the same as the standard 6010A. Calibration procedures are modified only by the fact that connections to the 6010A output signal must be made to the rear panel SYNTH OUTPUT connector instead of the front panel OUTPUT connector.

Option —05
IEEE-488 General Purpose Bus Interface

605-1. —05 OPTION, IEEE-488 GENERAL PURPOSE BUS INTERFACE

605-2. Introduction

605-3. The —05 option makes the 6010A meet the interface requirements as described in the IEEE-488, 1975 interface standard. A copy of the standard can be obtained, for approximately $10.00, from; The Institute of Electrical and Electronic Engineers, Inc., 345 East 47 Street, New York, NY 10017.

605-4. Operation

NOTE

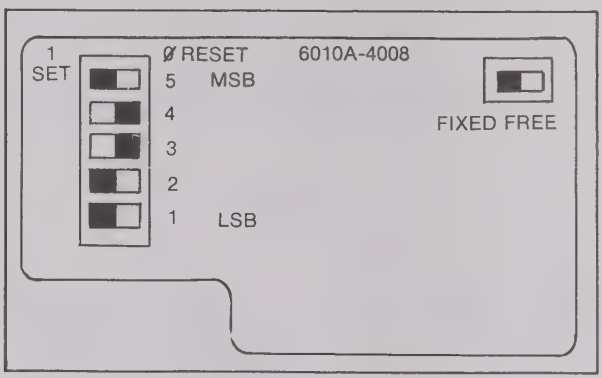
All schematic notations, logic levels and logic codes referenced in this discussion will be in the convention of POSITIVE TRUE logic. Additionally, all logic codes will be referenced at the IEEE bus. Therefore, a notation such as $\overline{DIO5}$ requires a Low voltage condition to become active while a notation such as RFD requires a High voltage condition to become active. All references to High and Low conditions in this discussion will indicate +5 volts and 0 volts, respectively, for the specific point mentioned.

605-5. Initial considerations in operating the 6010A equipped with the —05 option include selecting the listen address (0 through 30) and the programming format (fixed or free form) for the unit. Refer to Figures 605-1 and 605-5 for the discussion of this option. A set of five miniature switches is located in the upper left corner of the —05 option pcb (Figure 605-1). These switches carry a binary weight of 1, 2, 4, 8 and 16 for switches 1 through 5, respectively. The switches are set at the factory to provide a listen address of binary 19. This requires a listen address of 01100 (Positive True Logic) on the $\overline{DIO5}$ through $\overline{DIO1}$ lines of the IEEE-488 bus. Note that this is actually the complement of binary 19. However, the bus interface transfer circuits, U4 and U5, will invert the code to provide an address of 10011 (binary 19) for the internal operation of the IEEE-488 pcb logic. Additionally, bits 7 and 6 are hard wired so that they must be a logical 10 (Positive True Logic) on the IEEE-488 bus. This is due to the fact that bit 7 indicates a talker and bit 6 indicates a listener. Therefore, the complete logic code for the listen address example given is 1001100 (Positive True Logic) for $\overline{DIO7}$ through $\overline{DIO1}$. Bit 8 is ignored during addressing. The program format is selected by positioning the switch, located at the upper right corner of the pcb, to either FIXED or FREE. Fixed form remote programming is presented in Table 2-3 and Free Form programming in Table 2-4. When the listen address and program format have been selected, refer to the IEEE-488 interface standard for remote programming procedures.

605-6. Theory of Operation

605-7. This theory of operation is intended to identify the function of component groups in the —05 option circuitry. Identifying the function of the components should prove useful as an aid in troubleshooting improper option operation. The following description refers to the IEEE-488 schematic (Figure 605-5).

605-8. Interfacing between a remote controller and the 6010A-05 via the IEEE-488 bus is handled by four interface bus transfer integrated circuits, U4 through U7. For the 6010A to become a listener for a remote controller, the following conditions must be met. Remote Enable ($\overline{REN}$) must go Low. Then the listen address, as specified earlier in this discussion, must be placed on the $\overline{DIO7}$ through $\overline{DIO1}$ lines. This address must be accompanied by the Attention ($\overline{ATN}$) line going Low. With these conditions present, the Address Decoder, U1, will provide a High condition to the Listen and Remote circuits, U9 pins 1 and 8 respectively. Also, the $\overline{ATN}$ line going Low will enable the interface bus transfer circuit, U6, the Ready for Data (RFD) circuit,



ALLOWABLE LISTEN ADDRESSES

Binary No.	L5	L4	L3	L2	L1	ASCII	Character	Octal Equiv.
0	0	0	0	0	0	SP	Space	040
1	0	0	0	0	1	!	Exclamation mark	041
2	0	0	0	1	0	"	Quotation mark	042
3	0	0	0	1	1	#	Pound sign	043
4	0	0	1	0	0	$	Dollar sign	044
5	0	0	1	0	1	%	Percent	045
6	0	0	1	1	0	&	Ampersand	046
7	0	0	1	1	1	'	Apostrophe	047
8	0	1	0	0	0	(	Left parenthesis	050
9	0	1	0	0	1	)	Right parenthesis	051
10	0	1	0	1	0	*	Asterisk	052
11	0	1	0	1	1	+	Plus	053
12	0	1	1	0	0	,	Comma	054
13	0	1	1	0	1	—	Minus	055
14	0	1	1	1	0	.	Decimal point	056
15	0	1	1	1	1	/	Slant bar	057
16	1	0	0	0	0	0	Zero	060
17	1	0	0	0	1	1		061
18	1	0	0	1	0	2		062
*19	1	0	0	1	1	3		063
20	1	0	1	0	0	4		064
21	1	0	1	0	1	5		065
22	1	0	1	1	0	6		066
23	1	0	1	1	1	7		067
24	1	1	0	0	0	8		070
25	1	1	0	0	1	9		071
26	1	1	0	1	0	:	Colon	072
27	1	1	0	1	1	;	Semicolon	073
28	1	1	1	0	0	<	Less than	074
29	1	1	1	0	1	=	Equals	075
30	1	1	1	1	0	>	Greater than	076

**Factory setting*

Figure 605-1. IEEE-488 LISTEN ADDRESS AND PROGRAM FORMAT SWITCH LOCATIONS

U13-13, and the Data Accepted (DAC) circuit, U3-10. When U6 is enabled, the RFD line will be driven High by U13-3. A short time after the remote controller senses RFD High, it will drive the Data Valid (DAV) line Low. This will clock the Listen and Remote circuits (U9) changing their states and condition the RFD and DAC circuits. Changing the state of U9-6 to a Low will condition the 6010A for remote operation and changing U9-3 to a High will condition the instrument as a listener. The first clock pulse at J1-5, after DAV is present, will change the state of U13-2 and 3. This results in RFD being driven Low. The Low at U13-2 is gated with a Low on the Busy (BSY) line to provide a High to U13-8. On the second clock pulse, after DAV is present, U13-6 will go Low. This Low is gated with the Low at U13-2 to drive the Data Accepted (DAC) line High. When the remote controller senses DAC High, it will then drive ATN and DAV High. The next clock pulse at J1-5 will return the U13 circuits to their original condition. This drives DAC Low and RFD High. The 6010A is now a listener awaiting program information from the remote controller.

605-9. All codes placed on the IEEE-488 bus will be processed in the following manner provided they are NOT accompanied by the ATN line going Low. Refer to Figure 605-2 and Table 605-1 for the timing and events of the hand shake. A code is placed on the bus by the remote controller. Since RFD is High, there will be a short delay, then DAV will be driven Low by the controller. This will condition the RFD and DAC circuits, U13. The first clock pulse at J1-5, after DAV is present, will change the state of U13-2 and 3. U13-3 going High will drive RFD Low. Since ATN remains High, U13-2 going Low will drive the Data Ready (DRY) line High at J2-1. DRY going High indicates to the 6010A that there is data to be processed and causes the Busy (BSY) line to go High at J2-2. This disables U13-8 until the BSY line is cleared Low indicating that the data has been processed. The first clock, after BSY goes Low, will change the state of U13-6 causing the DAC line to be driven High. When this is sensed by the controller, DAV will be driven High. The next clock pulse will then clear the U13 circuits causing DAC to go Low and RFD to go High.

605-10. The universal command for Unlisten (1000000 in Positive True Logic at the IEEE-488 bus), when applied to the DIO7 through DIO1 lines and accompanied by ATN, will cause the Unlisten gate, U2-8, to provide a High to U9-4. When DAV is driven Low, a short time later, U9-3 will go Low. This disables the U6 circuit so a hand shake cannot be completed. Therefore this instrument is no longer a listener even though it is still in Remote. It is necessary to address the instrument again to make it become a listener, if it is desired to control the instrument remotely or return it to Local. The instrument may also be placed in the Unlisten condition by the Interface Clear (IFC) line being driven Low by the remote controller.

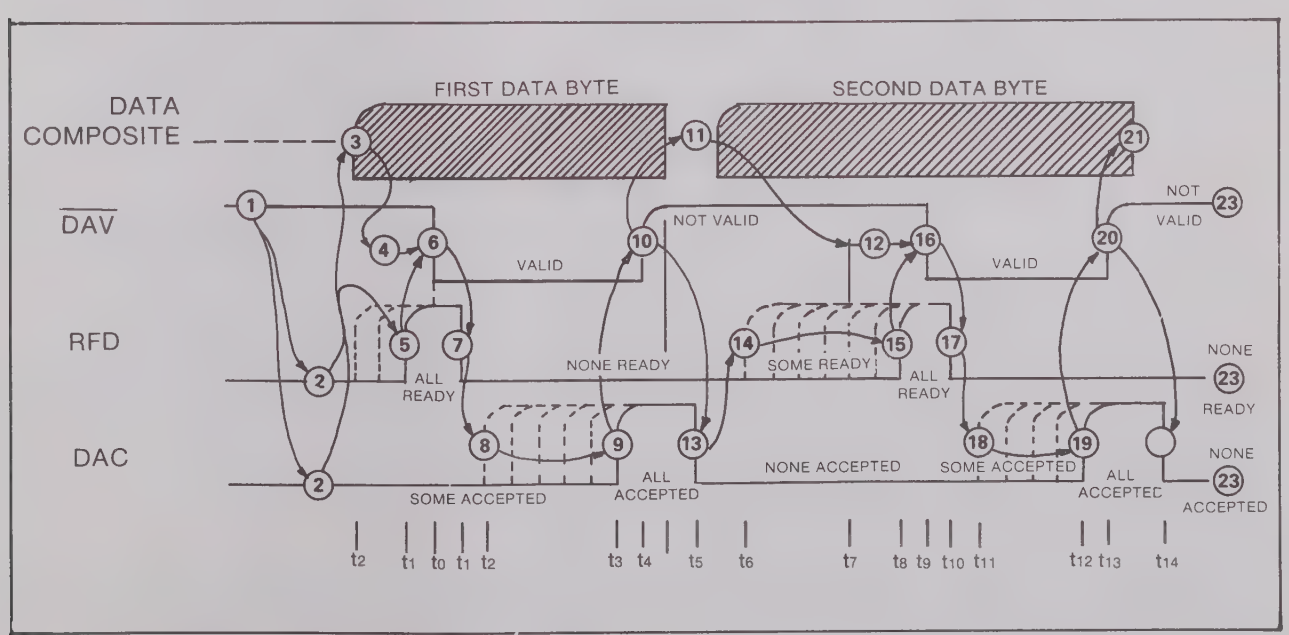


Figure 605-2. TIMING SEQUENCE FOR ONE TALKER AND MULTIPLE LISTENERS USING HAND SHAKE PROCESS

Table 605-1. LIST OF EVENTS FOR HAND SHAKE PROCESS

(1) —	Source initializes $\overline{DAV}$ to high (H) (data not valid).
(2) —	Acceptors initialize RFD to low (L) (none are ready for data), and set DAC to low (L) (none have accepted the data).
(3) t_{-2}	Source checks for error condition (both RFD and DAC high), then sets data byte on $\overline{DIO}$ lines.
(4) t_{-2} t_0	Source delays to allow data to settle on $\overline{DIO}$ lines.
(5) t_{-1}	Acceptors have all indicated readiness to accept first data byte; RFD line goes high.
(6) t_0	Source, upon sensing RFD high, sets $\overline{DAV}$ low to indicate that data on $\overline{DIO}$ lines is settled and valid.
(7) t_1	First acceptor sets RFD low to indicate that it is no longer ready, then accepts the data. Other acceptors follow at their own rates.
(8) t_2	First acceptor sets DAC high to indicate that it has accepted the data. (DAC remains low due to other acceptors driving DAC low.)
(9) t_3	Last acceptor sets DAC high to indicate that is has accepted the data; all have now accepted and the DAC line goes high.
(10) t_4	Source, having sensed that DAC is high, sets $\overline{DAV}$ high. This indicates to the acceptors that data on the $\overline{DIO}$ lines must now be considered not valid.
(11) t_4—t_7	Source changes data on the $\overline{DIO}$ lines.
(12) t_7—t_9	Source delays to allow data to settle on $\overline{DIO}$ lines.
(13) t_5	Acceptors, upon sensing $\overline{DAV}$ high (at 10) set DAC low in preparation for next cycle. DAC line goes low as the first acceptor sets the line low.
(14) t_6	First acceptor indicates that it is ready for the next data byte by setting RFD high. (RFD remains low due to other acceptors driving RFD low.)
(15) t_8	Last acceptor indicates that it is ready for the next data byte by setting RFD high; RFD signal line goes high.
(16) t_9	Source, upon sensing RFD high, sets $\overline{DAV}$ low to indicate that data on $\overline{DIO}$ lines is settled and valid.
(17) t_{10}	First acceptor sets RFD low to indicate that it is no longer ready, then accepts the data.
(18) t_{11}	First acceptor sets DAC high to indicate that it has accepted the data as in (8).
(19) t_{12}	Last acceptor set DAC high to indicate that it has accepted the data as in (9).
(20) t_{13}	Source, having sensed that DAC is high, sets $\overline{DAV}$ high as in (10).
(21) —	Source removes data byte from DIO signal lines after setting $\overline{DAV}$ high.
(22) t_{14}	Acceptors, upon sensing $\overline{DAV}$ high, set DAC low in preparation for next cycle.
(23) —	Note that all three hand shake lines are at their initialized states as in (1) and (2).

605-11. Another universal command that will be recognized by the 6010A-05, when it is operating as a remote listener, is the Go To Local Command (1111110) in Positive True Logic on the IEEE-488 bus). When this code is presented on the $\overline{DIO7}$ through $\overline{DIO1}$ lines and accompanied by $\overline{ATN}$ going Low, U3-8 will go Low. If the instrument is a listener, indicated by U9-2 being Low, U9-11 will go High. When $\overline{DAV}$ is driven Low, U9 will be clocked causing U9-6 to go High. This disables the Remote line to the 6010A instrument and it will return to a Local operation. Additionally, the Remote line will go High if $\overline{REN}$ is driven High by the remote controller.

605-12. Installation

605-13. Use the following procedure to install the —05 option in the 6010A. Refer to Figure 605-3 for the location of items referenced in the procedure.

1. Remove the 6010A top dust cover.

2. Swing Input/Output module out. (Remove six screws "A" and loosen two screws "B".)

3. If the 6010A is equipped with the FM or Phase Locked Input option, remove the mounting screws and lay the modules back out of the way.

4. Install the IEEE-488 Option (item 1). Secure it in place with three flat head screws (item 3).

5. Plug in cable assembly (item 2). Connect as follows:

IEEE	MAIN PCB
J1	J10
J2	XU45
J3	XU44

6. Replace FM and Phase Locked Input modules if removed.

7. Swing Input/Output module into place and secure it.

8. Replace top dust cover.

9. On the rear panel remote connector, remove screws that hold latching bail and discard screws and bail. Install connection mounting screws (item 4) in their place.

605-14. Troubleshooting

605-15. In the event that the 6010A fails to operate correctly from the remote control station, the instrument should be operated locally (front panel controls) in order to determine whether the problem is in the basic 6010A or the —05 option. If the instrument operates correctly from the front panel controls, the malfunction is likely to be found in the —05 option.

605-16. The step-by-step procedure provided in Table 605-2 will aid in isolating a malfunction in the —05 option circuitry.

605-17. —05 Option, List of Replaceable Parts

605-18. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the —05 option is provided in Table 605-2.

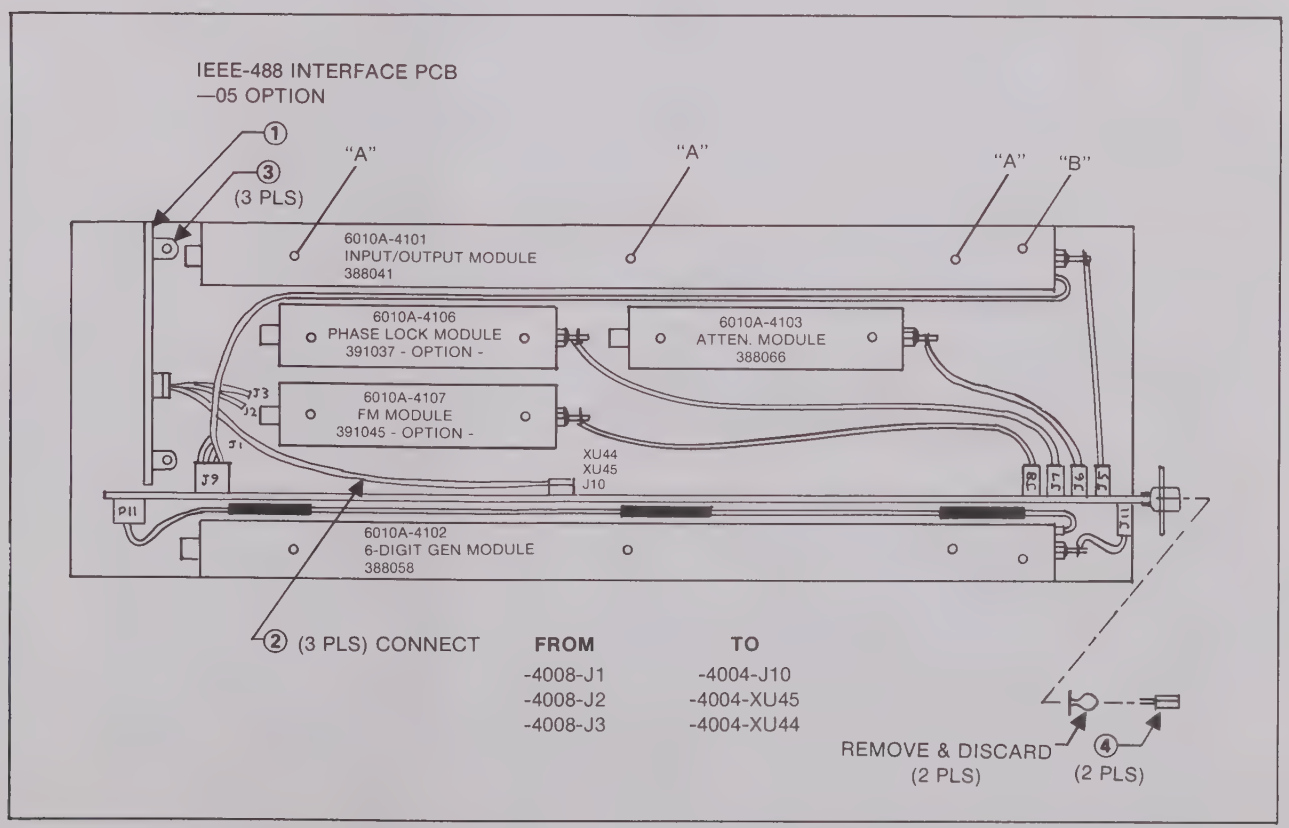


Figure 605-3. 6010A-05 INSTALLATION

Table 605-2. IEEE-488 INTERFACE TROUBLESHOOTING (Sheet 1 of 2)

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
	SELECTING REMOTE		
1	Ground J4-14, 13, 2, 1 (Address 19) and 11 ($\overline{\text{ATN}}$). Is U1-8 Low?	4	2
2	Are the U14 switches set for the correct address? (Binary 19 for the conditions of item No. 1.)	6	3
3	Set the U14 switches for the correct address. (Binary 19 for the conditiona of item No. 1.)		
4	Is U9-1 and 8 High?	8	5
5	U10 is the faulty device.		
6	Are the inputs to U1 High?	7	14
7	U1 is the faulty device.		
8	Ground J4-17 ($\overline{\text{REN}}$). Is U9-10 and 13 High?	9	15
9	Is J4-7 (RFD) High and J4-8 (DAC) Low?	10	52
	NOTE: J4-17 must remain grounded until all testing is completed.		
10	Ground J4-6 ($\overline{\text{DAV}}$). Did U9-2 and 6 go from High to Low?	11	16
11	Did U9-3 and 5 go from Low to High?	12	16
12	Is J4-7 (RFD) Low and J4-8 (DAC) High?	13	19
13	Remove ground from J4-11 ($\overline{\text{ATN}}$) only. Did U6-12 remain Low?	17	21
14	Check U4, 5, 8 and 11. One of these devices is faulty.		
15	Check U7, 10 and 11. One of these devices is faulty.		
16	Check applicable portion of U7, 9, 10 and 11. One of these devices is faulty.		
17	Remove ground from J4-6 ($\overline{\text{DAV}}$). Did J4-7 (RFD) go High and J4-8 (DAC) go Low?	18	22
18	–05 option is completing hand shake and becoming a remote listener correctly. Check interconnecting cables for malfunction.		
19	Are clock pulses present at J1-5?	20	25
20	U13 is likely the faulty device.		
21	U12 is likely the faulty device.		
22	Is J2-2 Low?	23	26
23	Are clock pulses present at J1-5?	24	25
24	Check applicable portions of U6, 11, 12, 13 and 18. One of these devices has malfunctioned.		
25	Malfunction is in main 6010A instrument.		
26	Determine why the 6010A microprocessor is still busy.		
	UNLISTEN (remove all grounds except J4-17 ($\overline{\text{REN}}$)).		
27	Ground J4-14, 13, 4, 3, 2, 1 (Unlisten code) and 11 ($\overline{\text{ATN}}$). Is U9-4 High?	28	30

Table 605-2. IEEE-488 INTERFACE TROUBLESHOOTING (Sheet 2 of 2)

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
28	Ground J4-6 ($\overline{\text{DAV}}$). Did U9-2 go High and U9-3 go Low?	29	32
29	–05 option is recognizing the unlisten code correctly.		
30	Is U2-8 Low?	31	34
31	U11 is faulty device.		
32	Did U9-12 go from High to Low?	33	36
33	U9 is the faulty device.		
34	Are all inputs to U2 High?	35	38
35	U2 is the faulty device.		
36	Did U6-3 go from Low to High?	37	39
37	U11 is the faulty device.		
38	Check U4, 5, 8 and 11. One of these devices is faulty.		
39	Check applicable section of U6.		
	GO TO LOCAL (remove all grounds except J4-17).		
40	Ground J4-14, 13, 12, 1 (Listen address ginary 19), 11 ($\overline{\text{ATN}}$) and 6 (DAV). This readdresses the –05 option to be a listener.		
41	Remove all grounds applied in item No. 40.		
42	Ground J4-1 (go to Local code) and 11 ($\overline{\text{ATN}}$). Did U9-11 go High?	43	45
43	Ground J4-6 ($\overline{\text{DAV}}$). Did U9-5 go Low and U9-6 go High?	44	48
44	–05 option is recognizing the Go To Local code correctly.		
45	Is U10-11 Low?	46	48
46	Is U3-8 Low?	47	49
47	U10 is the faulty device.		
48	U9 is the faulty device.		
49	Are all inputs to U3 High?	50	51
50	U3 is the faulty device.		
51	Check U4, 5, 8 and 11. One of these devices is faulty.		
52	Check U6, 11, 12, and 13. One of these devices is faulty.		

Table 605-3. IEEE-488 GENERAL PURPOSE BUS INTERFACE

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	IEEE-488 INTERFACE PCB ASSEMBLY (Figures 605-4 and 605-5)	411512	89536	411512	REF		
C1	Cap, plstc, 0.1 μF ±10%, 250V	161992	73445	C280AE/A100K	1		
C2	Cap, elect, 10 μF -10/+50%, 25V	170266	73445	ET100X025A2	1	1	
C3 thru C8	Cap, cer, 0.22 μF ±20%, 50V	309849	71590	CW30C224K	6		
J1, J2, J3	Socket conn., 16 pin	370312	01295	C931602	3		
R1	Res, comp, 390 ±5%, 1/4 W	147975	01121	CB3905	1		
S1	Switch, slide	393629	89536	393629	1	1	
U1, U2, U3	IC, TTL, pos NAND	404889	01295	SN74L330N	3	1	
U4 thru U7	IC, digital, quad interface bus trans.	404103	04713	MC3441P	4	1	
U8, U11	IC, digital, TTL, hex inverter	393058	01295	SN746S04N	2	1	
U9, U13	IC, digital, TTL, dual J-K neg. ET-F/F	393157	01295	SN74LS107N	2	1	
U10, U12	IC, digital, pos NOR gate, quad 2-input	393041	01295	SN74LS02N	2	1	
U14	Switch Dual Inline, 5 switches	417766	00779	435470-4	1		
U18	IC, digital, pos AND gate, 2-input	393066	01295	SN74LS08N	1		

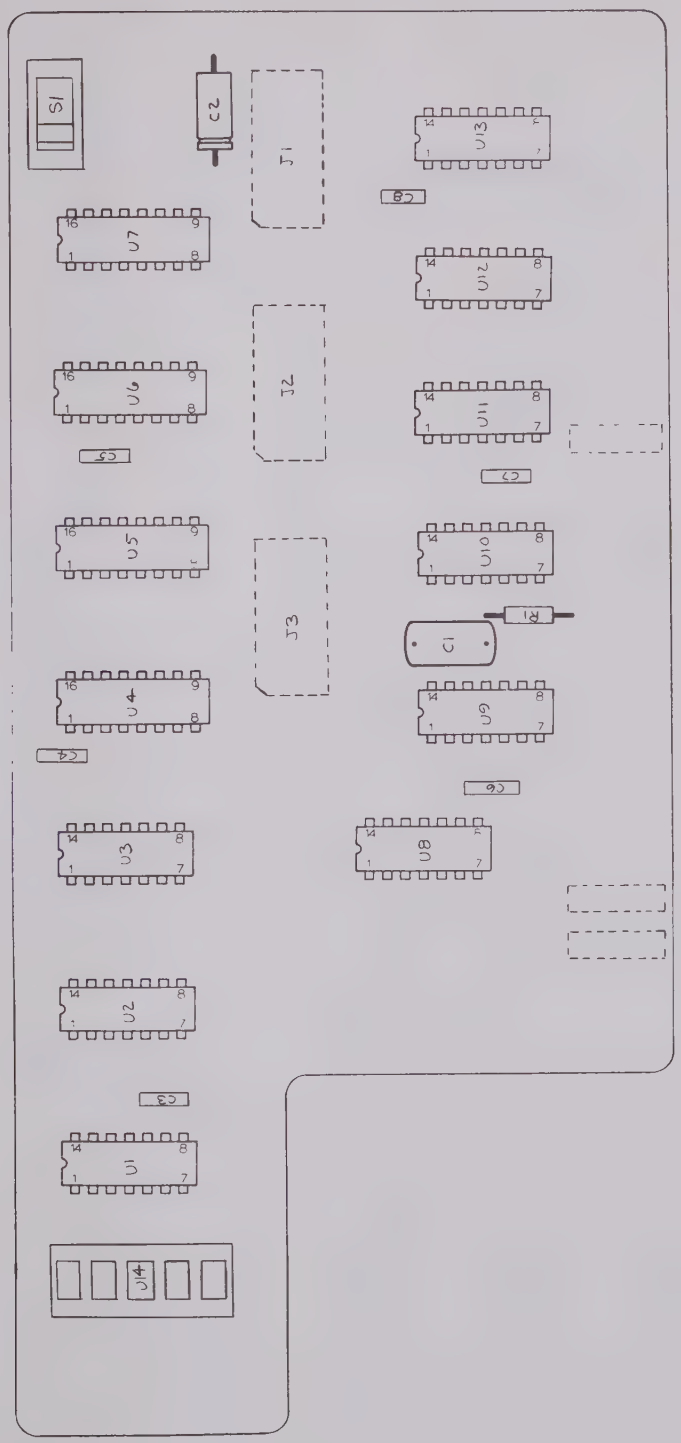


Figure 605-4. IEEE-488 INTERFACE COMPONENT LOCATION (6010A-1608)

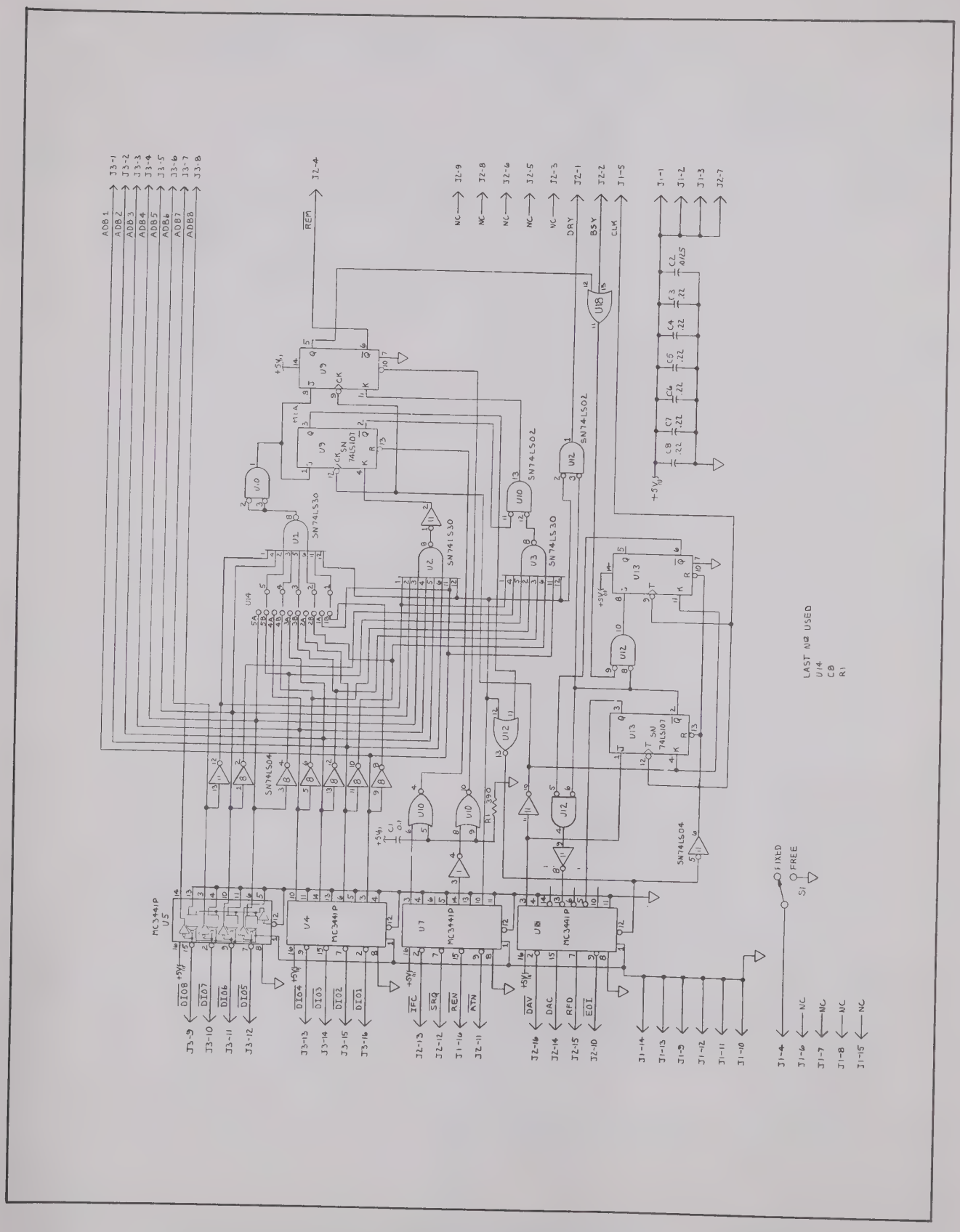


Figure 605-5. IEEE-488 SCHEMATIC (6010A-1008)

Option —06
EIA Standard RS-232C Interface

606-1. —06 OPTION, EIA STANDARD RS-232C INTERFACE

606-2. Introduction

606-3. The —06 option is a bit-serial binary data interface that meets the requirements defined by the EIA Standard RS-232C. The option provides for selection of either standard RS-232 voltage level or teletype-compatible 20 mA current loop inputs. Switch S1, located on the back side of the option pcb, can be placed in the CURRENT LOOP or VOLTAGE position; right and left respectively, as viewed from the front of the instrument.

606-4. The —06 option includes features like the following. Asynchronous data rates selectable from 110 baud to 9600 baud. A 32 character first-in, first-out buffer memory enables the option to accept input data in high rate bursts. The option will return a status character when it is ready for more data.

606-5. Operation

606-6. An interconnect cable is supplied with the —06 option. Pin 19 (FIXED/FREE FORMAT) has been jumpered to pin 11 (GND) placing the 6010A remote programming in the free format. Changing to fixed format requires removing the back shell from the 25 pin male connector and cutting the jumper between pins 11 and 19. A second jumper between pin 9 (REM) and 11 places the instrument in remote programming mode of operation. This jumper can be cut and pin 9 wired to a TTL gate or switch to control the remote operation of the 6010A.

606-7. The baud rate can be set for 110, 150, 300, 600, 1200, 2400, 4800 or 9600 by placing a jumper between the selected baud rate (right side of the socket) and the output (any left side pin). This socket is located on the front side of the —06 pcb in the lower left hand corner. The selected baud rate must be compatible with the controlling device.

606-8. When the baud rate, type of input (current loop or voltage), and data format (fixed or free form) are selected for compatibility with the intended control device the 6010A-4456 adapter cable can be connected between the control device and the 6010A remote control input. The 6010A is programmed for remote control operation when the adapter cable is plugged in (caused by the jumper between pin 9 and 11 of the 24 pin connector). The pin assignment of data flow between the control device and the 6010A is shown in Table 606-1.

606-9. Theory of Operation

606-10. Control data is applied to the 6010A via the 6010A-4456 adapter cable through the 6010A rear panel REMOTE CONTROL connector. As shown in Table 606-1 the input and output data transmission lines are separate for current loop data transfer or voltage level data transfer (see RS-232C schematic.) Switch S1, located on the interface pcb, selects the desired mode of data input operation. Current loop data is applied to the interface pcb on pins 15 and 14 of J1; output data is from J1 pins 9 and 10. Voltage level data is applied to the interface pcb on J2 pins 16 and 10 and the output taken from pins 15 and 11.

Table 606-1. 6010A-4456 ADAPTER CABLE PIN ASSIGNMENTS

6010A SYNTHESIZED SIGNAL GENERATOR	6010A-4456 ADAPTER CABLE ASSEMBLY PIN ASSIGNMENTS		RS-232C DESCRIPTION		
Function (Remote Connector J4 on Rear Panel)	"24 Pin" Conn. J1	"25 Pin" Conn. J2	Data Flow	Circuit	Description
SDI (Serial Data In)	6	3	←	BB	Rec'd Data
Signal Ground	5	7		AB	Signal Gnd
SDO (Serial Data Out)	7	2	→	BA	Transmitted Data
Send Source +	20	11	→		20 mA Transmitted Data
Send Return -	23	12	→		
Received Source +	12	13	←		20 mA Received Data
Received Return -	18	14	←		
Chassis Ground	24	1		AA	Protective Gnd
Remote Control Format	19 wired	N/C			
Signal Ground	11 to-	N/C			
REM (Remote Control Order)	9 gether	N/C			
	N/C	wired 8	←	CF	Rec'd Line Sig. Det.
		together 20	→	CD	Data Term. Ready
	N/C	wired 4	→	CA	Request to Send
		together 5	←	CB	Clear to Send
	N/C	6	←	CC	Data Set Ready
Grounded on Interface Card	17, 21, 22	N/C			
N/C	All other pins	N/C			
	N/C	All other pins			N/C

606-11. The data is applied serially to pin 20 of U1, a Universal Asynchronous Receiver Transmitter (UART). The data is arranged into an eight-bit parallel format and transmitted, via pins 5 through 12 of U1 to U2, a First-In-First-Out (FIFO) buffer memory. The data can, because of the buffer memory, be applied to the RS-232C interface pcb faster than the 6010A, by itself, could receive the data. The 6010A calls the stored commands from the memory at a rate it can handle as controlled by the normal data transfer routine described in section two of this manual.

606-12. Output data from the RS-232C pcb is limited to the Reduce Output Level (ROL) data. The ROL data is applied to pin 13 of data multiplexer U11 via J2 pin 6. Three other data bits D01 on J1 pin 6, D08 on J1 pin 7 and D05 on J1 pin 8 are all tied to common on the 6010A main pcb. The logic level changes of the ROL bit (high indicating that the programmed output level is too high) are part of a four bit data word that is applied to U1. This four bit word is then sent out in serial via J1 pins 9 and 10 to the 6010A remote control connector.

606-13. The receiver and transmitter clock signals, applied to U1 pins 17 and 40 respectively, are derived from the 1.228 MHz output of Y1. Dividers U6, U7 and U8 reduce the Y1 output to frequencies, selectable by jumper at X1, which are equal to 16 times the baud rate. The selected transmitter and receiver clock frequency determines the speed at which the RS-232C interface will receive or transmit data. The baud rate must be selected to be compatible with the transmit/receive rate of the device controlling the 6010A.

606-14. Installation

606-15. Use the following procedure to install the —06 option in the 6010A. Refer to Figure 606-1 for the location of items referenced in the procedure.

1. Remove the 6010A top dust cover.

2. Swing the Input/Output module out. (Remove six screws "A" and loosen two screws "B".)

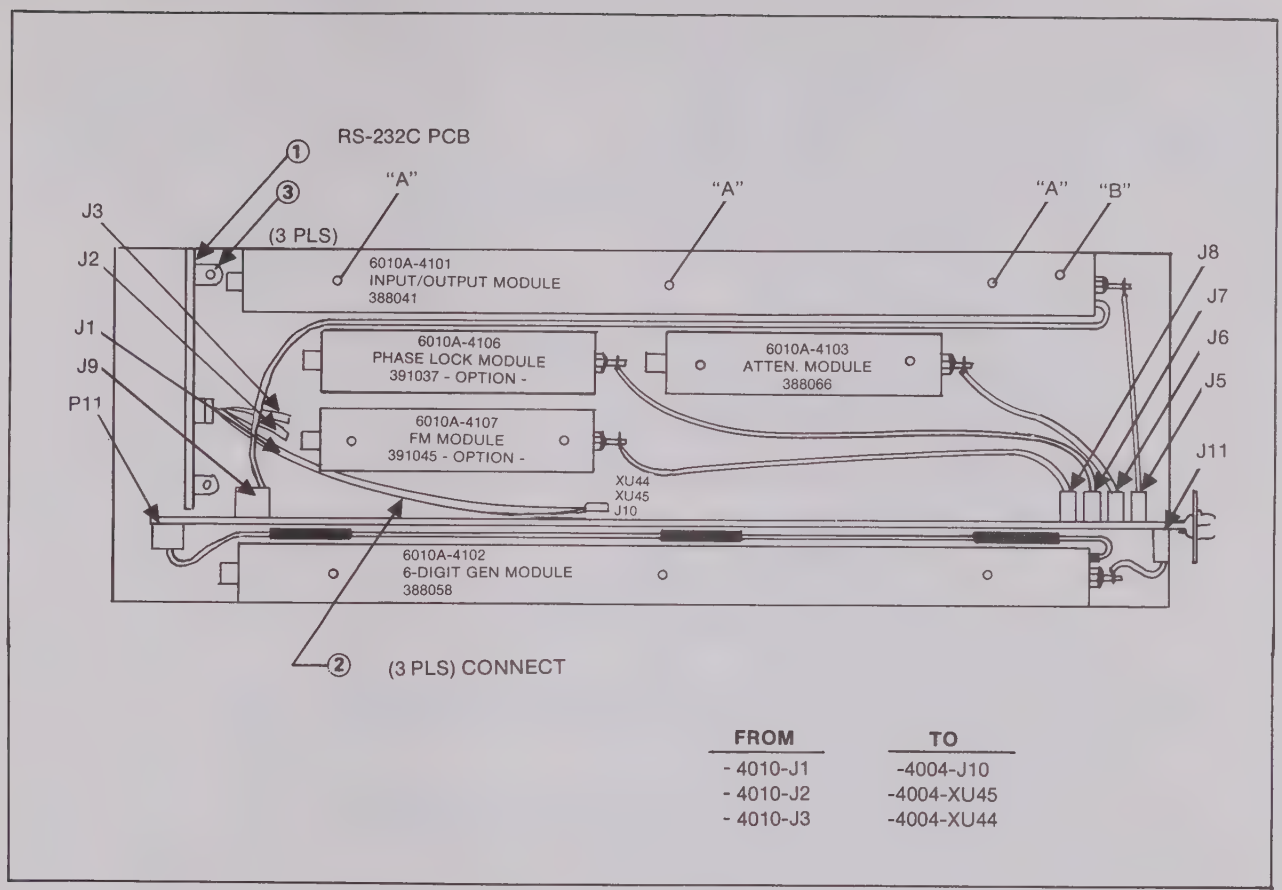


Figure 606-1. RS-232C INSTALLATION

3. If the 6010A is equipped with the FM or Phase Locked Input option, remove the mounting screws and lay the modules back out of the way.

4. Install the RS-232C option (item 1). Secure it in place with three flat head screws (item 3).

5. Plug in the cable assembly (item 2). Connect as follows:

RS-232C	MAIN PCB
J1	J10
J2	UX45
J3	UX44

6. Replace the FM and Phase Locked Input modules if removed.

7. Swing the Input/Output module into place and secure it.

8. Replace top dust cover.

9. On the rear panel remote connector, remove the screws that hold the latching bail and discard the screws and bail. Install connector mounting screws in their place.

606-15. Troubleshooting

606-16. In the event that the 6010A fails to operate correctly from the remote control station the instrument should be operated locally (front panel controls) in order to determine whether the problem is in the basic 6010A operation or the —06 option. If the instrument operates correctly from the front panel controls, the malfunction is likely to be in the —06 option circuitry.

606-17. —06 Option, List of Replaceable Parts

606-18. For column entry explanations, part ordering information, and basic instrument configuration refer to Section 5 of this manual. A list of parts for the —06 option is provided in Table 606-3.

Table 606-2. RS-232C TROUBLESHOOTING

ITEM NO.	PROCEDURE	OUTCOME	
		YES	NO
1	Is the baud rate selected (jumpered at X1) compatible with the controller.	3	2
2	Select the correct baud rate.		
3	Is the frequency of the signal at TP1 (U8 pin 5) 614 kHz?	5	4
4	U15 or U8 is the probable faulty component.		
5	Is the frequency of the signal at U1 pin 40 sixteen times the selected baud rate?	7	6
6	U4, U6, U7 or U8 is the probable faulty part.		
7	Is the data applied to U1 pin 20 correct? (Use an oscilloscope to observe the logic changes.)	9	8
8	U16 (for current loop inputs) or U13 (for voltage level inputs) is the probable faulty component.		
9	Enter the code for a question mark (?). Are U12 pins 7 and 15 at a low level?	13	10
10	Are U12 pins 1, 2, 3 and 6 and U17 pins 9, 10 and 11 at a high logic level?	11	12
11	U12 or U17 is the probable faulty component.		
12	U1 or U2 is the probable faulty component.		
13	Check for logic level changes at U4 pin 6, U5 pin 8, U3 pin 10, U15 pin 8 and U5 pin 6.		

Table 606-3. EIA STANDARD RS-232C INTERFACE (Sheet 1 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	RS-232C INTERFACE (Figures 606-2 and 606-3)	425223	89536	425223	REF		
C1, C2	Cap, cer, 0.025 μF ±20%, 100V	168435	56289	C023B101H253M	2		
C3	Cap, fxd, Ta, 10 μF ±10%, 10V	176214	56289	196D106X0010 KA1	1		
C4, C5,	Cap, elect, 10 μF -10/+50%, 25V	170266	73445	ET100X025A2	3	1	
C7 thru C13	Cap, cer, 0.22 μF ±20%, 50V	309849	71590	CW30C224K	7		
CR1, CR2	Diode, si, multipellet	375485	03508	MPD300	2	1	
CR3	Diode, si, hi-speed switch	203323	07910	1N4448	1	1	
J1, J2, J3	Socket, connector	370312	01295	C931602	4		
Q1	Xstr, si, PNP	195974	04713	2N3906	1		
R1, R2	Res, fxd, comp, 510 ±5%, 1/4 W	218032	01121	CB5115	2		
R3	Res, fxd, comp, 1.1k ±5%, 1/4 W	267336	01121	CB1125	1		
R4, R5, R6	Res, fxd, comp, 3k ±5%, 1/4 W	193508	01121	CB3025	1		
R7	Res, fxd, comp, 1k ±5%, 1/4 W	148023	01121	CB1025	1		
R8	Res, fxd, comp, 620 ±5%, 1/4 W	221903	01121	CB6215	1		
R9	Res, fxd, comp, 2.2k ±5%, 1/4 W	148049	01121	CB2225	1		
R10	Res, fxd, comp, 47 ±5%, 1/4 W	147892	01121	CB4705	1		
R11	Res, fxd, comp, 750 ±5%, 1/4 W	218024	01121	CB7515	1		
S1	Switch, slide, DPDT	393629	10389	23-021-114	1	1	
U1	IC, digital, asynchronous receiver/ transmitter	354753	05828	AY-5-1013A	1	1	
U2	IC, digital, MOS, 32X8 FIFO memory	404095	34335	AM2812ADC	1	1	
U3, U15	IC, digital, TTL, hex inverter	393058	01295	SN74LS04N	3	1	

Table 606-3. EIA STANDARD RS-232C INTERFACE (Sheet 2 of 2)

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
U4	IC, digital, TTL, pos AND gates	393066	01295	SN74LS08N	1	1	
U5	IC, digital, TTL, quad, 2-input, pos OR gates	393108	01295	SN74LS32	1	1	
U6	IC, digital, TTL, dual 4-bit binary counter clocks	419069	01295	SN74393N	1	1	
U7	IC, digital, TTL, decade and binary counters	402552	01295	SN74390	1	1	
U8, U9, U10	IC, digital, TTL, low power, Schottky, dual "D" with clear and preset	393124	01295	SN74LS74N	3	1	
U11	IC, digital, TTL, low power, quad, 2-line to 1-line, data selector/multiplexer	393025	01295	SN74L157N	1	1	
U12	IC, digital, TTL, low power, Schottky, 3 to 8 line decoder	407585	01295	SN74LS138N	1	1	
U13	IC, digital, TTL, MSI dual communications, EIE/MIL line receivers	354704	18324	8T16A	1	1	
U14	IC, digital, TTL, MSI dual communications, EIE/MIL line driver	354696	18324	N8T15A	1	1	
U16	IC, digital, TTL, pos NAND gates	393033	01295	SN74LS00N	1	1	
U17	IC, digital, TTL, triple 3-input, pos AND gates	393082	01295	SN74LS11	1	1	
XU1	Socket, IC, 40 pin	376244	01295	C934002	1		
XU2	Socket, IC, 28 pin	419077			1		
Y1	Crystal, 1.228 MHz	352344	75378	SCC815A	1		
	Cable Assy	427054	89536	427054	1		
	Strap, rubber component holder	104794	98159	2829-115-3	1		
	Mounting Clip	306225	73734	36-515	3		
	Conn, red, tip jack	170480	74970	105-752	3		

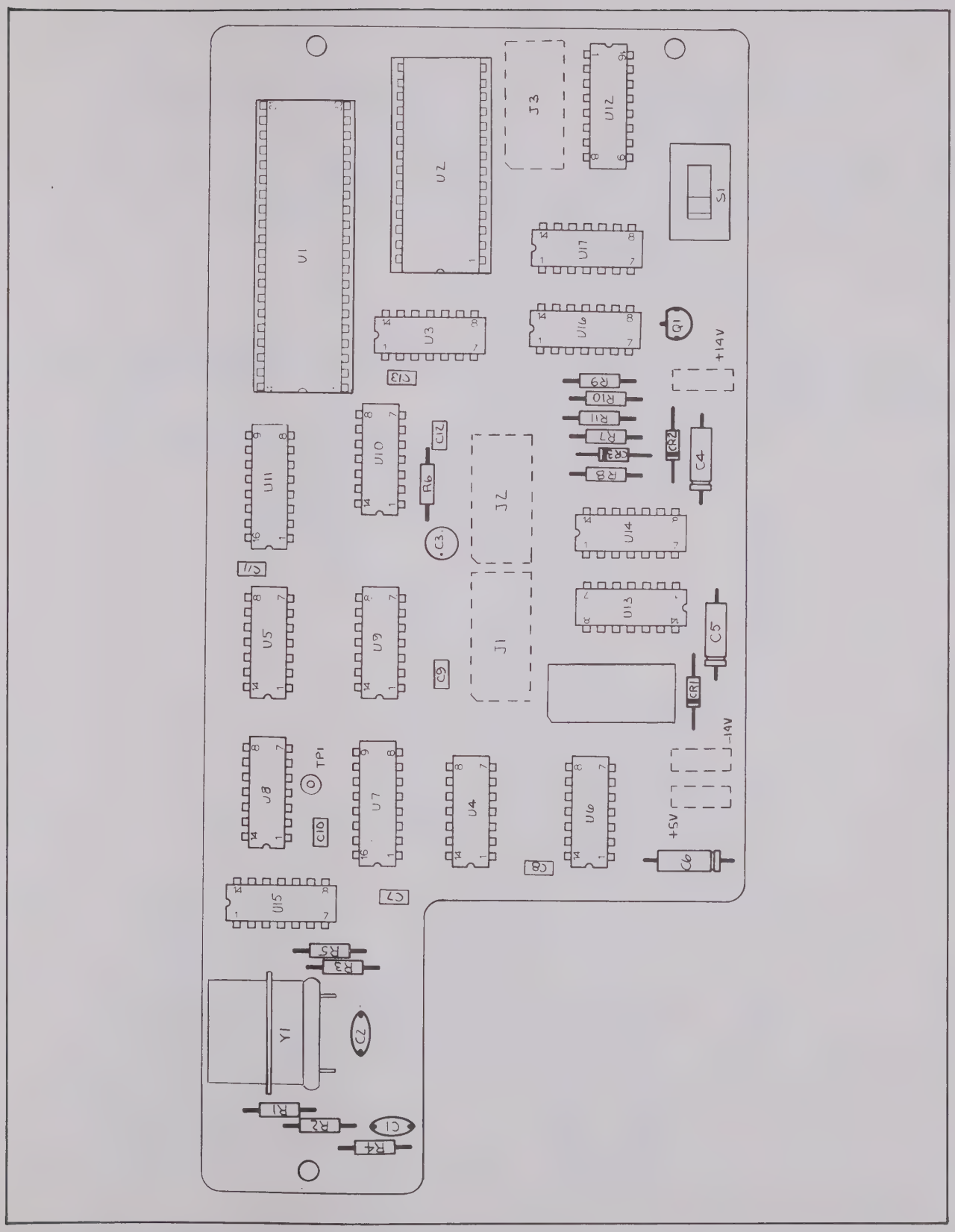


Figure 606-2. RS-232C INTERFACE COMPONENT LOCATION (6010A-1610)

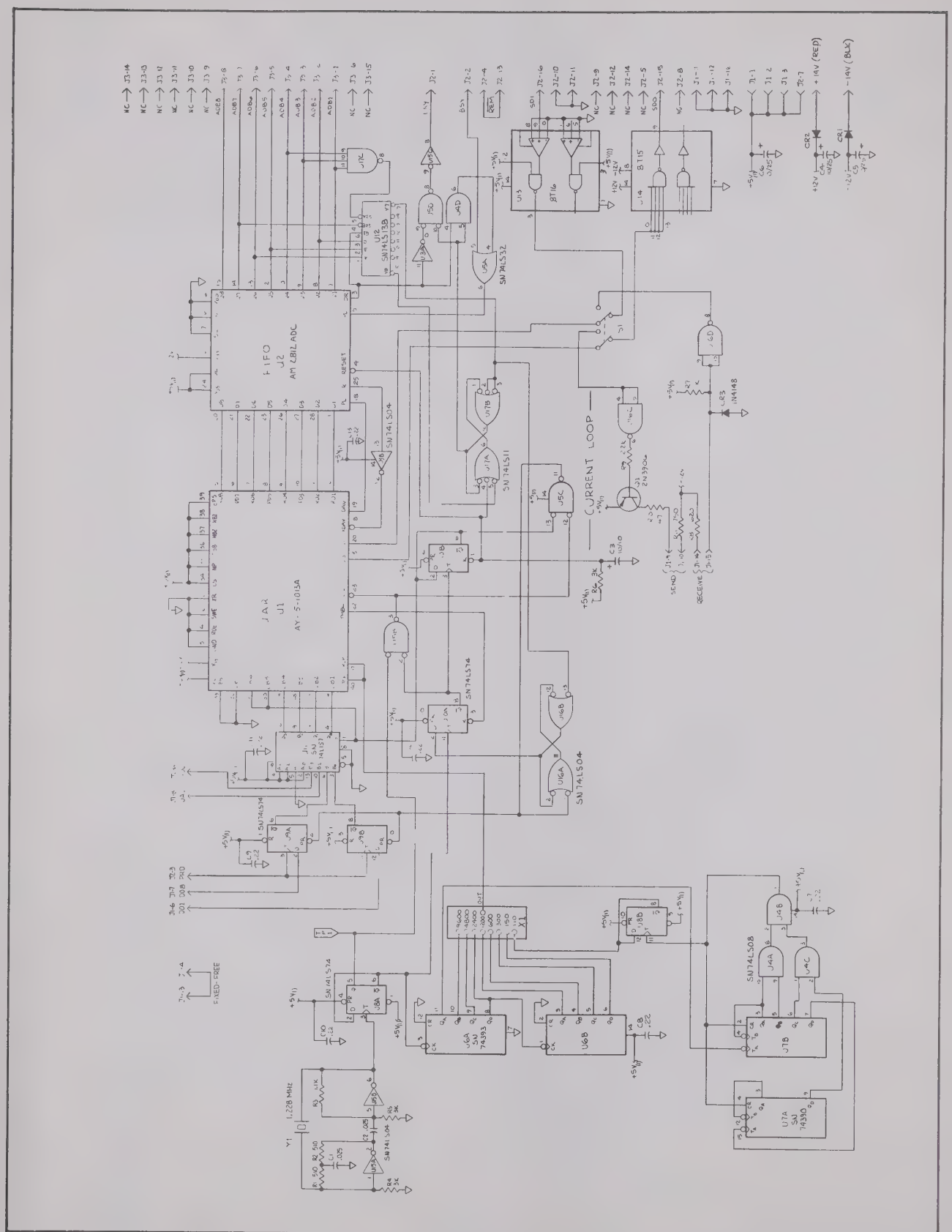


Figure 606-3. RS-232C INTERFACE SCHEMATIC (6010A-1010)

Option —07
50-400 Hz Line Power

607-1. —07 OPTION, 50 to 400 Hz LINE POWER

607-2. The —07 option allows the 6010A to be operated from line power sources of 115 or 230V ac at 50 to 400 Hz. Operation of the 6010A equipped with the —07 option is the same as a standard unit except for the frequency of the line power source. Refer to Section 2 for operation of the 6010A.

Option —08
100V, 50-60 Hz Line Power

608-1. —08 OPTION, 100V, 50 to 60 Hz LINE POWER

608-2. The —08 option provides for instrument operation from 100V ac 50 to 60 Hz power sources. Operation of the 6010A equipped with the —08 option is the same as a standard unit except for the line power voltage level. Refer to Section 2 for operation of the 6010A.

Option —09
20-31 MHz Tracking Output

609-1. —09 OPTION, 20-31 MHz TRACKING OUTPUT

609-2. The —09 option provides a 6010A rear panel output of a TTL level signal at a frequency of 20 to 31 MHz. The output has a 10 Hz resolution and will be equal in frequency to the 6010A output (in high range) plus 20 MHz; i.e., a 2.16837 MHz 6010A front panel output will result in a 22.16837 MHz tracking output signal. Normal operation of the 6010A is not affected by the —09 option. If the —09 option is to be installed simultaneously with the —04 Rear Output option the —09 option must be installed in the FM IN rear panel mounting hole.

Option —10
75Ω Output Impedance

610-1. —10 OPTION, 75 OHM OUTPUT IMPEDANCE

610-2. The output impedance of the 6010A front panel signal, normally 50 ohms, can be changed to 75 ohms by ordering the 6010A equipped with the —10 option. The operating characteristics of the 6010A are not affected by the —10 option. Refer to Section 2 for operating instructions.

610-3. The following list, Table 610-1, describes the components unique to the —10 option. This list added to the parts list in Section 5 will provide the parts list for the —10 option.

Table 610-1. 75 OHM OUTPUT IMPEDANCE OPTION

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	75 OHM OUTPUT IMPEDANCE OPTION						
	(Parts located on Attenuator module)						
R6	Res, fxd, mf, 14Ω, ±0.1, 1/4 W	436162	91637	LMF-414R0B	1		
R7	Res, fxd, mf, 11Ω, ±0.1, 1/4 W	436154	91637	LMF1-411R0B	1		
	(Parts not on Attenuator module)						
	Nameplate, 75 ohm output	437954	89536	437954	1		
	Decal, 75 ohm option output level	429001	89536	429001	1		
	Decal, 75 ohm output	428912	89536	428912	1		

Section 7

General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers — U.S. and Canada

Sales and Service Locations — International

Sales Representatives — U.S. and Canada

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
^{o}C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
^{o}F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^{9})
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^{3})
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^{6})
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(—) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers (Continued)

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

Federal Supply Codes for Manufacturers (Continued)

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onatrio, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

Federal Supply Codes for Manufacturers (Continued)

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
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South Boston, Massachusetts

81073
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La Grange, Illinois

81312
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Div. of Litton Industries Inc.
Oakville, Connecticut

81439
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Mansfield, Ohio

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82305
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Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
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Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

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formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
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Centrelab Electronics Div. of
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El Monte, California

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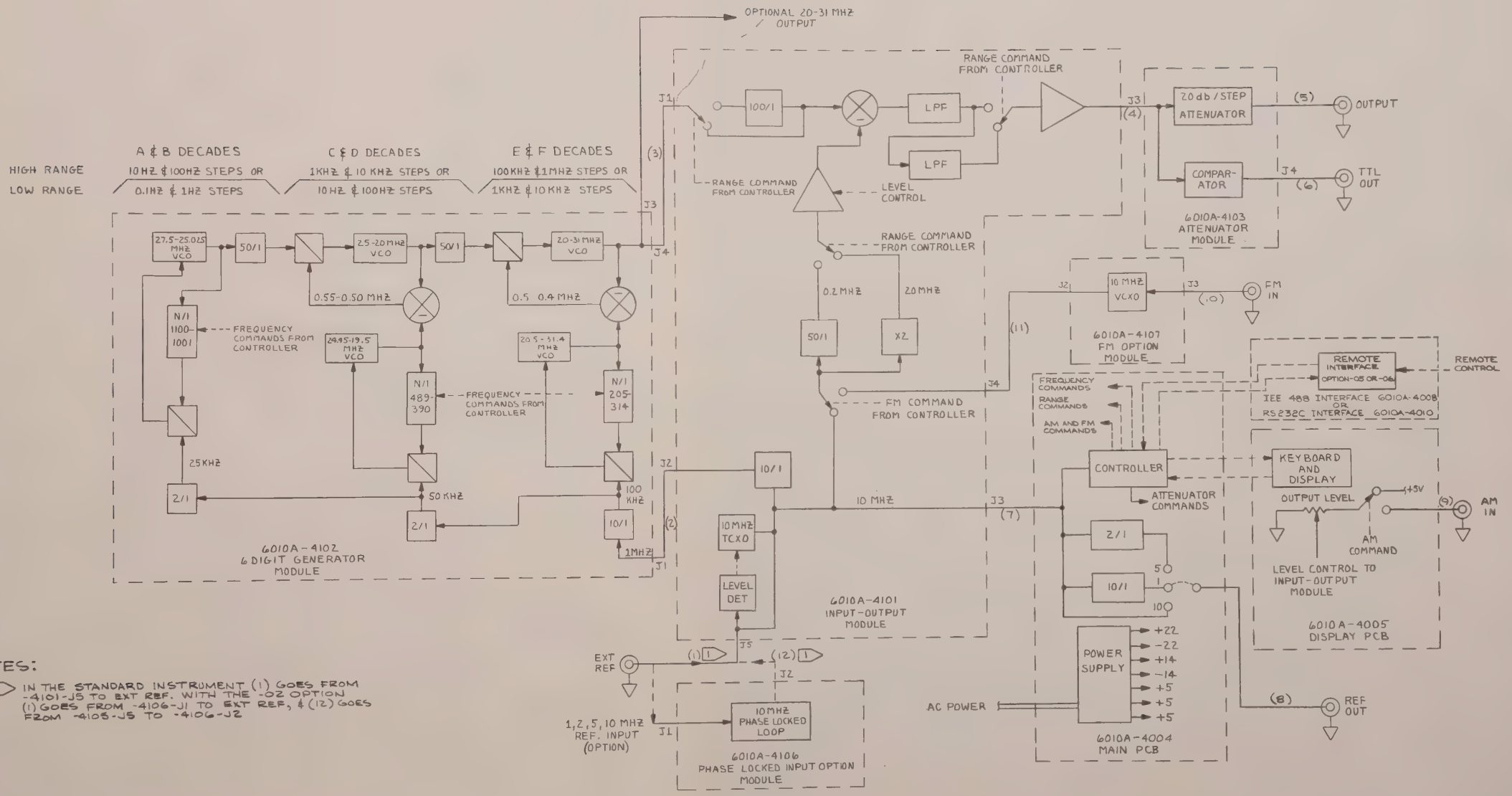
Beaverton, OR (503) 644-4783

Section 8
Schematic Diagrams

FIGURE NO.	TITLE	DRAWING NO.	PAGE
8-1	6010A Block Diagram (Sheet 1 of 2)	6010A-1501	8-3
8-2	Interconnect Diagram (Sheet 1 of 2)	6010A-1502	8-5
8-3	Input/Output PCB Assembly (Sheet 1 of 3)	6010A-1001	8-7
8-4	6-Digit Generator PCB Assembly (Sheet 1 of 6)	6010A-1602	8-10
8-5	Attenuator and Square Wave Output PCB Assembly (Sheet 1 of 2)	6010A-1603	8-16
8-6	Main PCB Assembly (Sheet 1 of 4)	6010A-1604	8-18
8-7	Front Panel PCB Assembly (Sheet 1 of 2)	6010A-1605	8-22



NOTES:

1. IN THE STANDARD INSTRUMENT (1) GOES FROM -4101-J5 TO EXT REF. WITH THE -02 OPTION (1) GOES FROM -4106-J1 TO EXT REF, & (12) GOES FROM -4105-J5 TO -4106-J2

Figure 8-1. 6010A Block Diagram (Sheet 1 of 2)

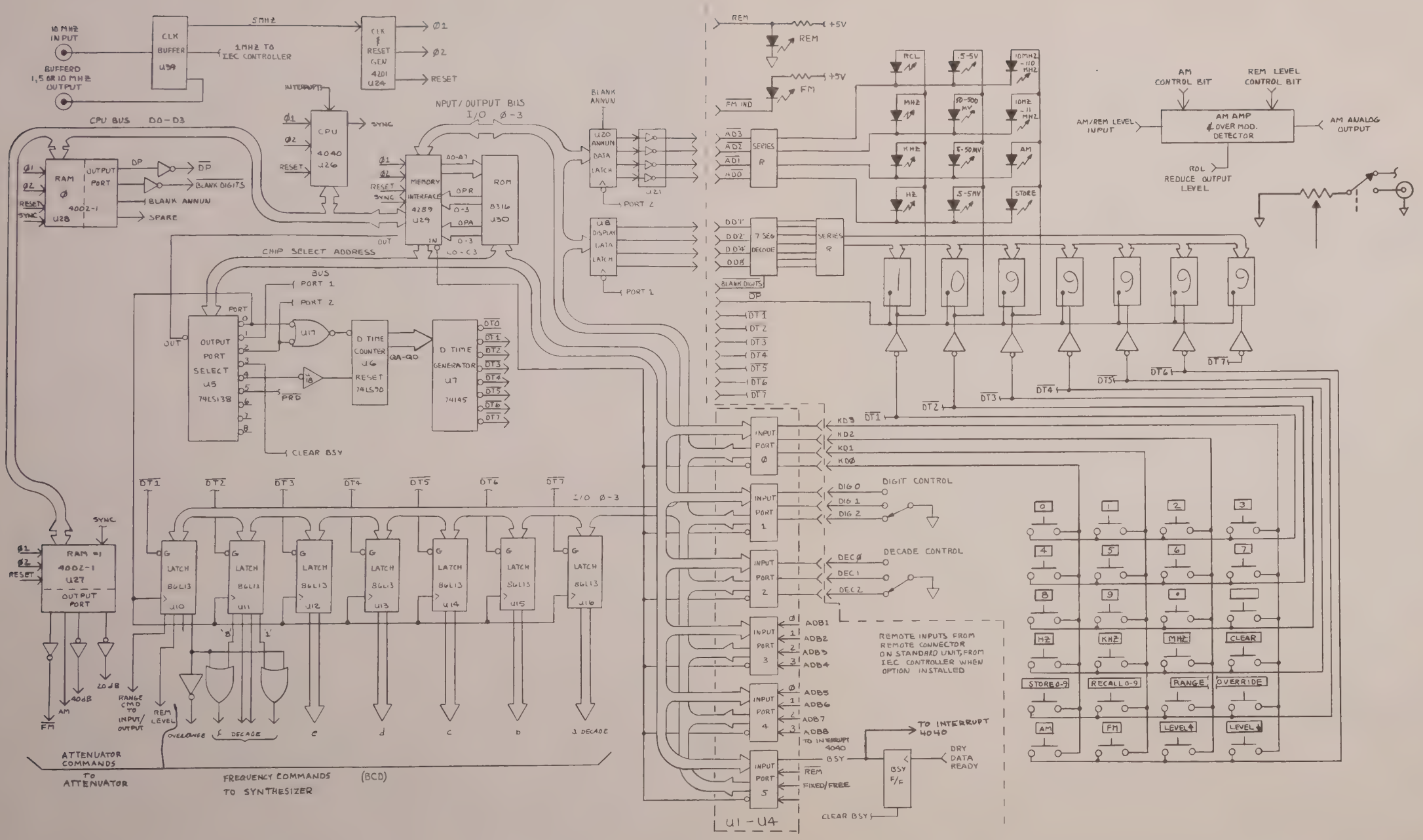


Figure 8-1. 6010A Block Diagram (Sheet 2 of 2)

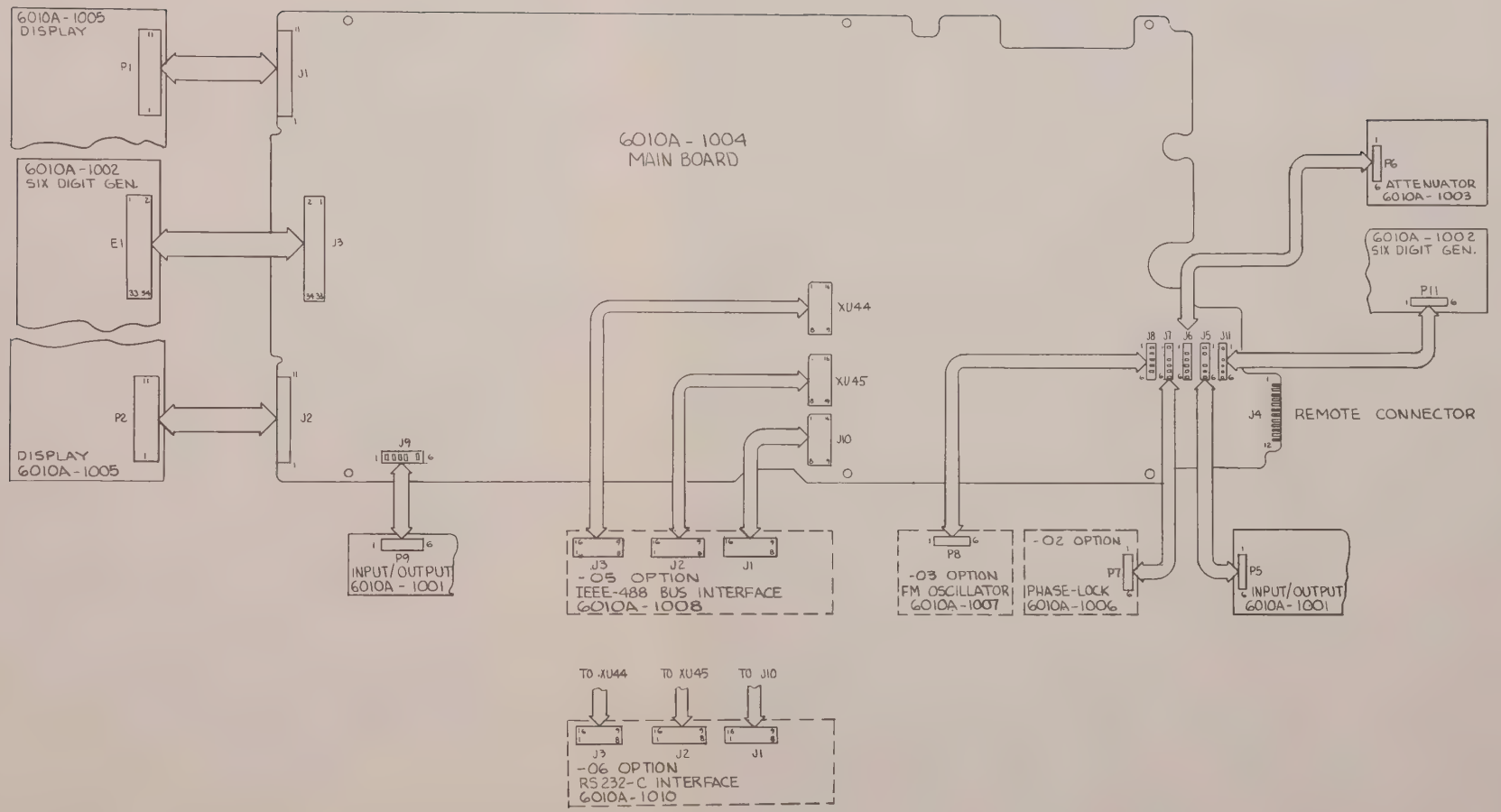


Figure 8-2. Interconnect Diagram (Sheet 1 of 2)

FUNCTION TABLE		
CONNECTOR	PIN NO.	FUNCTION
6010-1005-P1	1	DT5
	2	DT6
	3	DT3
	4	DEC2
	5	DEC0
	6	DIG1
	7	DECIMAL POINT
	8	GND
	9	+5V(1)
	10	DD2
	11	DD8
	12	DT2
	13	DT7
	14	DT1
	15	DT4
	16	DEC1
	17	DIG2
	18	DIG0
	19	BLANK DIGITS
	20	+5V(1)
	21	DD4
	22	DD1
6010A-1005-P2	1	AM/REM LEVEL INPUT
	2	AM/LEVEL ANALOG
	3	GND(1)
	4	REM LEVEL
	5	ROL
	6	GND(2)
	7	-14V
	8	REM
	9	KD3
	10	FM CONTROL
	11	KD2
	12	+14V
	13	+5V(2)
	14	AM
	15	GND(1)
	16	GND(2)
	17	AD3
	18	AD0
	19	AD2
	20	AD1
	21	KD1
	22	KD0
6010A-1002-E1	1	OVERRANGE
	2	OVERRANGE
	3	NC
	4	NC
	5	'4' b DECADE CONTROL INPUT
	6	'1' b DECADE CONTROL INPUT
	7	NC
	8	'8' f DECADE CONTROL INPUT
	9	'2' b DECADE CONTROL INPUT
	10	'8' b DECADE CONTROL INPUT
	11	'4' a DECADE CONTROL INPUT
	12	f DECADE OVERRANGE '1'
	13	'1' a DECADE CONTROL INPUT
	14	'2' a DECADE CONTROL INPUT
	15	GND
	16	'8' a DECADE CONTROL INPUT
	17	'1' d DECADE CONTROL INPUT
	18	GND
	19	GND
	20	'4' d DECADE CONTROL INPUT
	21	'1' e DECADE CONTROL INPUT
	22	'8' e DECADE CONTROL INPUT
	23	'8' d DECADE CONTROL INPUT
	24	'2' d DECADE CONTROL INPUT
	25	'4' e DECADE CONTROL INPUT
	26	'2' e DECADE CONTROL INPUT
	27	'4' c DECADE CONTROL INPUT
	28	'1' c DECADE CONTROL INPUT
	29	'8' c DECADE CONTROL INPUT
	30	'2' c DECADE CONTROL INPUT
	31	'4' f DECADE CONTROL INPUT
	32	'2' f DECADE CONTROL INPUT
	33	'1' f DECADE CONTROL INPUT
	34	'8' f DECADE CONTROL INPUT
6010A-1002-P11	1	+14V (BRN)
	2	KEY
	3	-14V (RED)
	4	+5V(3) (ORN)
	5	NC
	6	NC
6010A-1001-P9	1	GND (BRN)
	2	AM LEVEL ANALOG (RED)
	3	GND (ORN)
	4	RANGE CONTROL (YEL)
	5	KEY
	6	FM CONTROL (GRN)

FUNCTION TABLE		
CONNECTOR	PIN NO.	FUNCTION
6010A-1001-P5	1	-14V (BRN)
	2	+14V (RED)
	3	KEY
	4	+22V (ORN)
	5	-22V (YEL)
	6	+5V(2) (GRN)
6010A-1006-P7	1	+14V (BRN)
	2	KEY
	3	-14V (RED)
	4	+5V(2) (ORN)
	5	NC
	6	NC
6010A-1003-P6	1	KEY
	2	-14V (BRN)
	3	+22V (RED)
	4	+5V(2) (ORN)
	5	20 dB (YEL)
	6	40 dB (GRN)
6010A-1007-P8	1	+14V (BRN)
	2	-14V (RED)
	3	+5V(2) (ORN)
	4	FM (YEL)
	5	FM CONTROL (GRN)
6010A-1008-J1 (-05 OPTION)	1	+5V
	2	+5V
	3	+5V
	4	FIXED/FREE FORMAT
	5	CLK
	6	NC
	7	NC
	8	NC
	9	GND
	10	GND
	11	GND
	12	GND
	13	GND
	14	GND
	15	NC
	16	REN
6010A-1008-J2 (-05 OPTION)	1	DRY
	2	BSY
	3	PRD
	4	REM
	5	NC
	6	NC
	7	+5V
	8	NC
	9	NC
	10	EOI
	11	ATN
	12	SRQ
	13	IFC
	14	DAC
	15	RFD
	16	DAV
6010A-1008-J3 (-05 OPTION)	1	ADB 1
	2	ADB 2
	3	ADB 3
	4	ADB 4
	5	ADB 5
	6	ADB 6
	7	ADB 7
	8	ADB 8
	9	DIO8
	10	DIO7
	11	DIO6
	12	DIO5
	13	DIO4
	14	DIO3
	15	DIO2
	16	DIO1
6010A-1004-J1	1	DT5
	2	DT6
	3	DT3
	4	DEC2
	5	DEC0
	6	DIG1
	7	DECIMAL POINT
	8	GND
	9	+5V(3)
	10	DD2
	11	DD8
	12	DT2
	13	DT7
	14	DT1
	15	DT4
	16	DEC1
	17	DIG2
	18	DIG0
	19	BLANK DIGITS
	20	+5V(3)
	21	DD4
	22	DD1

FUNCTION TABLE		
CONNECTOR	PIN NO.	FUNCTION
6010A-1004-J2	1	AM/REM LEVEL INPUT
	2	AM/LEVEL ANALOG
	3	GND(1)
	4	REM LEVEL
	5	ROL
	6	GND(2)
	7	-14V
	8	REM
	9	KD3
	10	FM CONTROL
	11	KD2
	12	+14V
	13	+5V(2)
	14	AM
	15	GND(1)
	16	GND(2)
	17	AD3
	18	AD0
	19	AD2
	20	AD1
	21	KD1
	22	KD0
6010A-1004-J3	1	OVERRANGE
	2	OVERRANGE
	3	NC
	4	NC
	5	'4' b DECADE CONTROL
	6	'1' b DECADE CONTROL
	7	NC
	8	'8' f DECADE CONTROL
	9	'2' b DECADE CONTROL
	10	'8' b DECADE CONTROL
	11	'4' a DECADE CONTROL
	12	f DECADE OVERRANGE '2'
	13	'1' a DECADE CONTROL
	14	'2' a DECADE CONTROL
	15	GND
	16	'8' a DECADE CONTROL
	17	'1' d DECADE CONTROL
	18	GND
	19	GND
	20	'4' d DECADE CONTROL
	21	'1' e DECADE CONTROL
	22	'8' e DECADE CONTROL
	23	'8' d DECADE CONTROL
	24	'2' d DECADE CONTROL
	25	'4' e DECADE CONTROL
	26	'2' e DECADE CONTROL
	27	'4' c DECADE CONTROL
	28	'1' c DECADE CONTROL
	29	'8' c DECADE CONTROL
	30	'2' c DECADE CONTROL
	31	'4' f DECADE CONTROL
	32	'2' f DECADE CONTROL
	33	'1' f DECADE CONTROL
	34	'8' f DECADE CONTROL

6010A-1004-J4 (REMOTE CONN)	STANDARD REMOTE	-05 OPTION	-06 OPTION
1	ADB 1	DIO 1	*
2	ADB 2	DIO 2	*
3	ADB 3	DIO 3	*
4	ADB 4	DIO 4	*
5	+5V(1)	EOI	GND
6	DRY	DAV	SDI
7	BSY	RFD	SDO
8	PRD	DAC	*
9	REM	IFC	REM
10	SPARE	SRQ	*
11	ROL	ATN	GND
12	SPARE	SHIELD	*
13	ADB 5	DIO 5	*
14	ADB 6	DIO 6	*
15	ADB 7	DIO 7	*
16	ADB 8	DIO 8	*
17	SPARE	REN	*
18	SPARE	GND (6)	*
19	F/FF ▷	GND (7)	F/FF ▷
20	SPARE	GND (8)	*
21	SPARE	GND (9)	*
22	SPARE	GND (10)	*
23	SPARE	GND (11)	*
24	GND	GND LOGIC	CHASSIS GND

6010A-1004-J5	
1	-14V
2	+14V
3	KEY
4	+22V
5	-22V
6	+5V(2)

6010A-1004-J6	
1	KEY
2	-14V
3	+22V
4	+5V(2)
5	20 dB
6	40 dB

FUNCTION TABLE		
CONNECTOR	PIN NO.	FUNCTION
6010A-1004-J7	1	+14V
	2	KEY
	3	-14V
	4	+5V(2)
	5	NC
	6	NC
6010A-1004-J8	1	+14V
	2	-14V
	3	+5V(2)
	4	FM
	5	FM CONTROL
	6	KEY
6010A-1004-J9	1	GND(1)
	2	AM/LEVEL ANALOG
	3	GND(1)
	4	RANGE CONTROL
	5	KEY
	6	FM CONTROL

6010A-1004-J10	STANDARD	-05 OPTION	-06 OPTION
1	+5V(1)	+5V(1)	+5V
2	+5V(1)	+5V(1)	+5V
3	+5V(1)	+5V(1)	+5V
4	F/FF ▷	F/FF ▷	F/FF ▷
5	CLK	CLK	*
6	GND	GND	GND
7	GND	GND	GND
8	GND	GND	GND
9	SPARE	GND (8)	*
10	SPARE	GND (11)	*
11	SPARE	GND (10)	*
12	SPARE	GND (9)	*
13	F/FF ▷	GND (7)	F/FF ▷
14	SPARE	GND (6)	*
15	SPARE	SHIELD	*
16	SPARE	REN	*

6010A-1004-XU44	STANDARD	-05 OPTION	-06 OPTION
1	ADB 1	ADB 1	ADB 1
2	ADB 2	ADB 2	ADB 2
3	ADB 3	ADB 3	ADB 3
4	ADB 4	ADB 4	ADB 4
5	ADB 5	ADB 5	ADB 5
6	ADB 6	ADB 6	ADB 6
7	ADB 7	ADB 7	ADB 7
8	ADB 8	ADB 8	ADB 8
9	ADB 8	DIO 8	*
10	ADB 7	DIO 7	*
11	ADB 6	DIO 6	*
12	ADB 5	DIO 5	*
13	ADB 4	DIO 4	*
14	ADB 3	DIO 3	*
15	ADB 2	DIO 2	*
16	ADB 1	DIO 1	*

6010A-1004-XU45	STANDARD	-05 OPTION	-06 OPTION
1	DRY	DRY	DRY
2	BSY	BSY	BSY
3	PRD	PRD	PRD
4	REM	REM	REM
5	U4-14	U4-14	U4-14
6	ROL	ROL	ROL
7	+5V(1)	+5V(1)	+5V(1)
8	GND	GND	GND
9	GND	GND	GND
10	+5V(1)	EOI	GND
11	ROL	ATN	GND
12	SPARE	SRQ	*
13	REM	IFC	REM
14	PRD	DAC	*
15	BSY	RFD	SDO
16	DRY	DAV	SDI

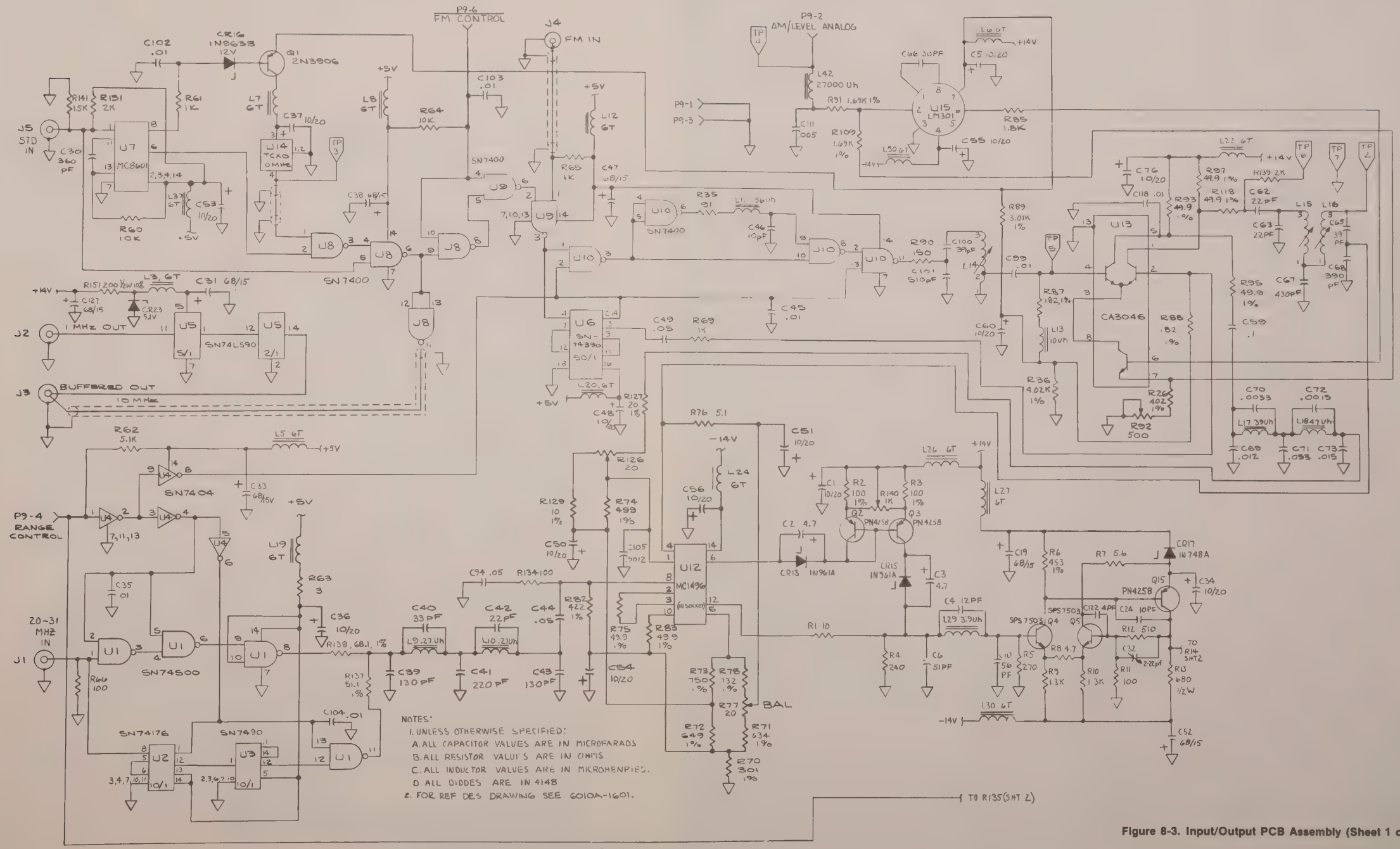
6010A-1004-J11		
1	+14V	(BRN)
2	KEY	
3	-14V	(RED)
4	+5V(3)	(ORN)
5	NC	
6	NC	

Figure 8-2. Interconnect Diagram (Sheet 2 of 2)

FUNCTION TABLE				
CONNECTOR	PIN NO.	STANDARD	-05 OPTION	-06 OPTION
6010A-1010-J1 (-06 OPTION)	1	+5V(1)		
	2	+5V(1)		
	3	+5V(1)		
	4	F/FF ▷		
	5	*		
	6	DD1		
	7	DD2		
	8	DAS		
	9	*		
	10	*		
	11	*		
	12	*		
	13	F/FF ▷		
	14	*		
	15	*		
	16	*		
6010A-1010-J2 (-06 OPTION)	1	DRY		
	2	BSY		
	3	PRD		
	4	REM		
	5	*		
	6	ROL		
	7	+5V(1)		
	8	*		
	9	*		
	10	GND		
	11	GND		
	12	*		
	13	REM		
	14	*		
	15	SDO		
	16	SDI		
6010A-1010-J3 (-06 OPTION)	1	ADB 1		
	2	ADB 2		
	3	ADB 3		
	4	ADB 4		
	5	ADB 5		
	6	ADB 6		
	7	ADB 7		
	8	ADB 8		
	9	*		
	10	*		
	11	*		
	12	*		
	13	*		
	14	*		
	15	*		
	16	*		

NOTES:

1. ▷ FIXED/FREE FORMAT
2. * NOT USED
3. ▷ THESE INPUTS ARE GND ON 6010A.
4. REMOTE INPUTS ARE POSITIVE TRUE



LAST PART NO. USED.		OPEN
R 152	L 50	U11
C 127	CR23	R136, 128, 130, 146-150
Q 31	U18	C18
		CR22

Figure 8-3. Input/Output PCB Assembly (Sheet 1 of 3)

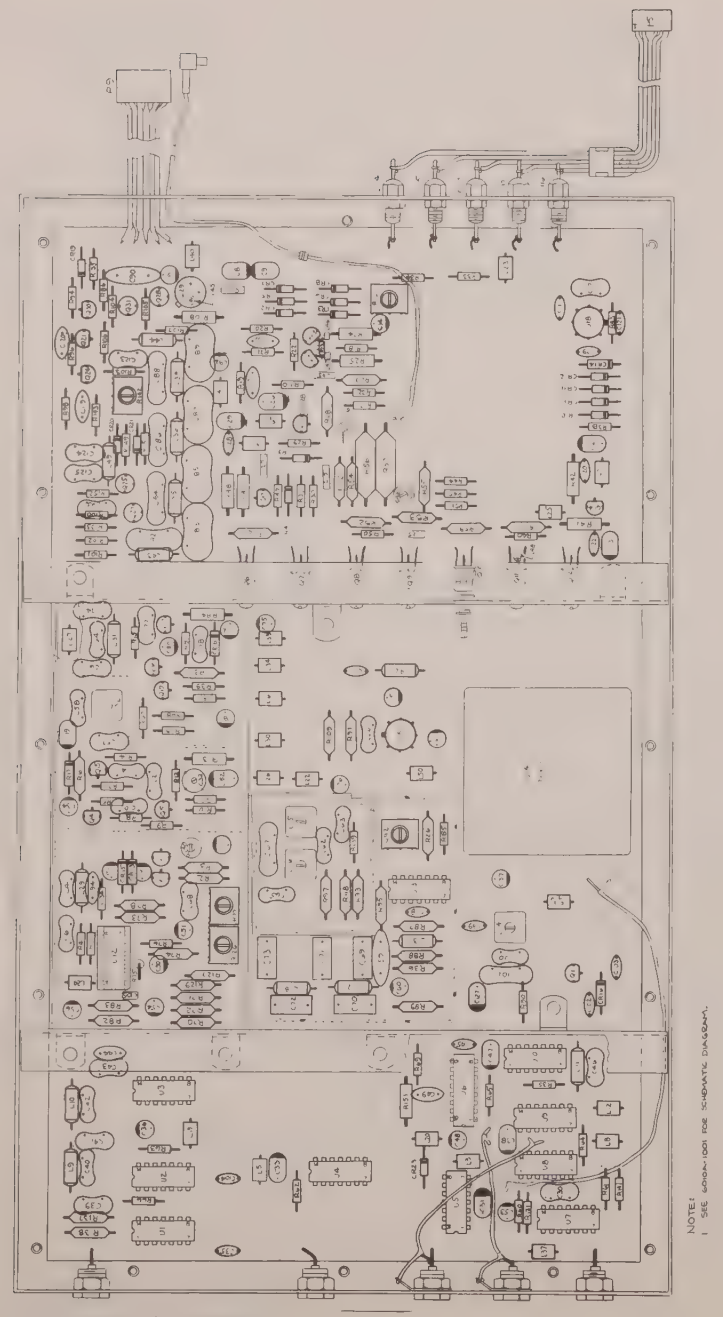


Figure 8-3. Input/Output PCB Assembly (Component Location) (Sheet 2 of 3)

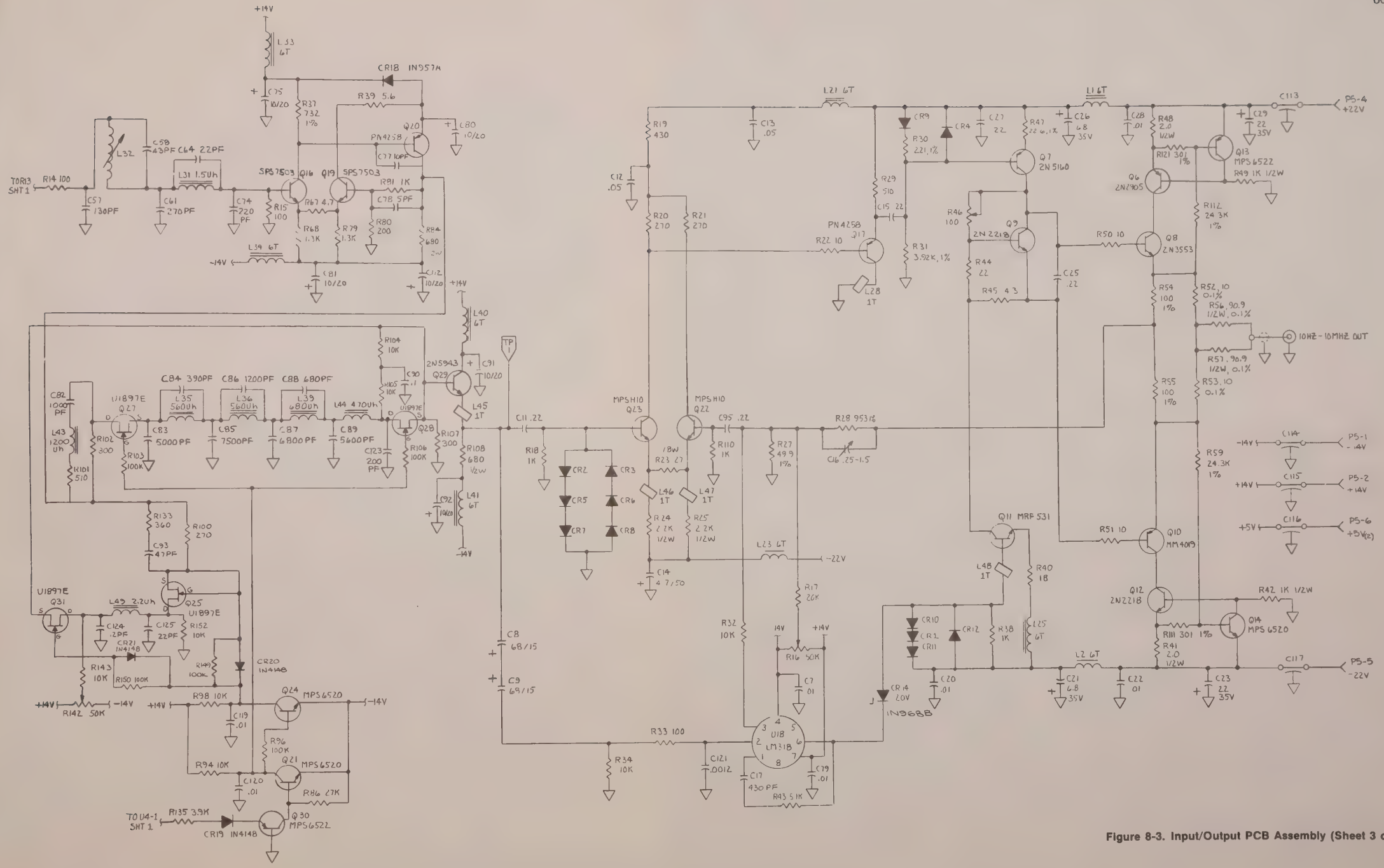


Figure 8-3. Input/Output PCB Assembly (Sheet 3 of 3)

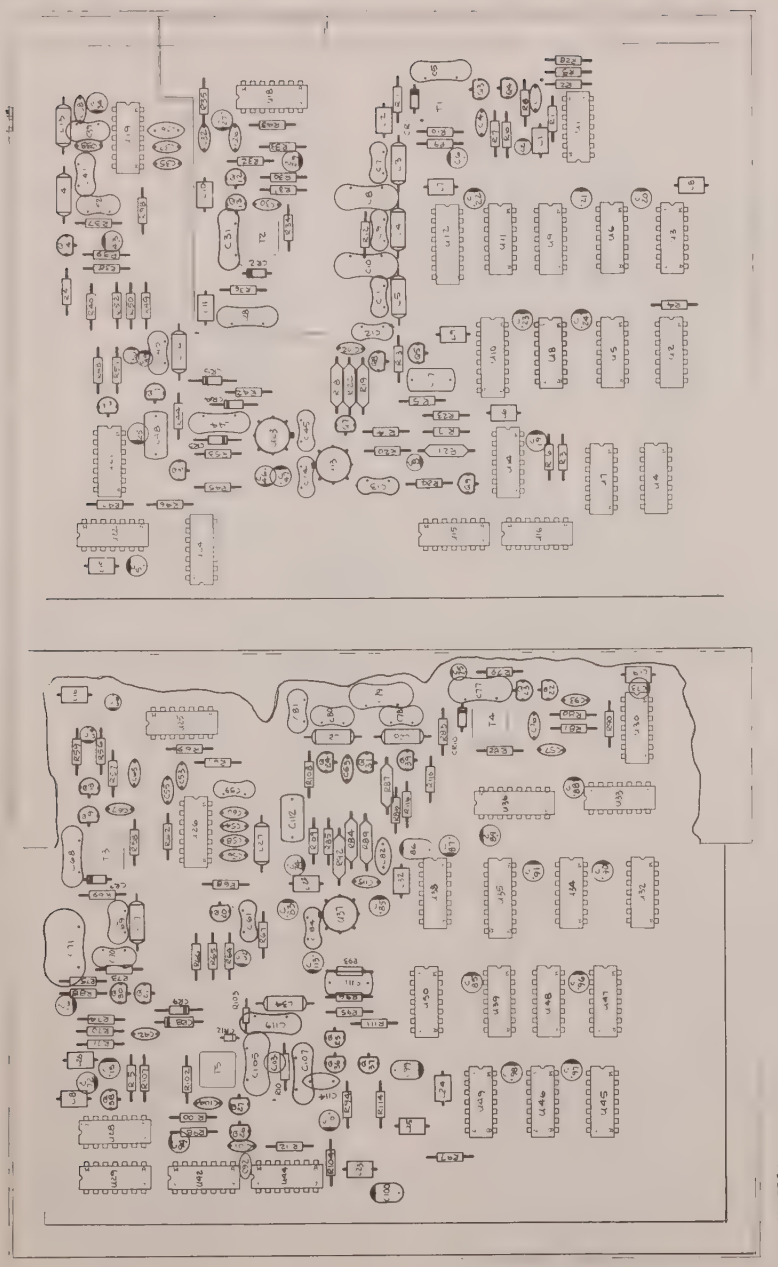
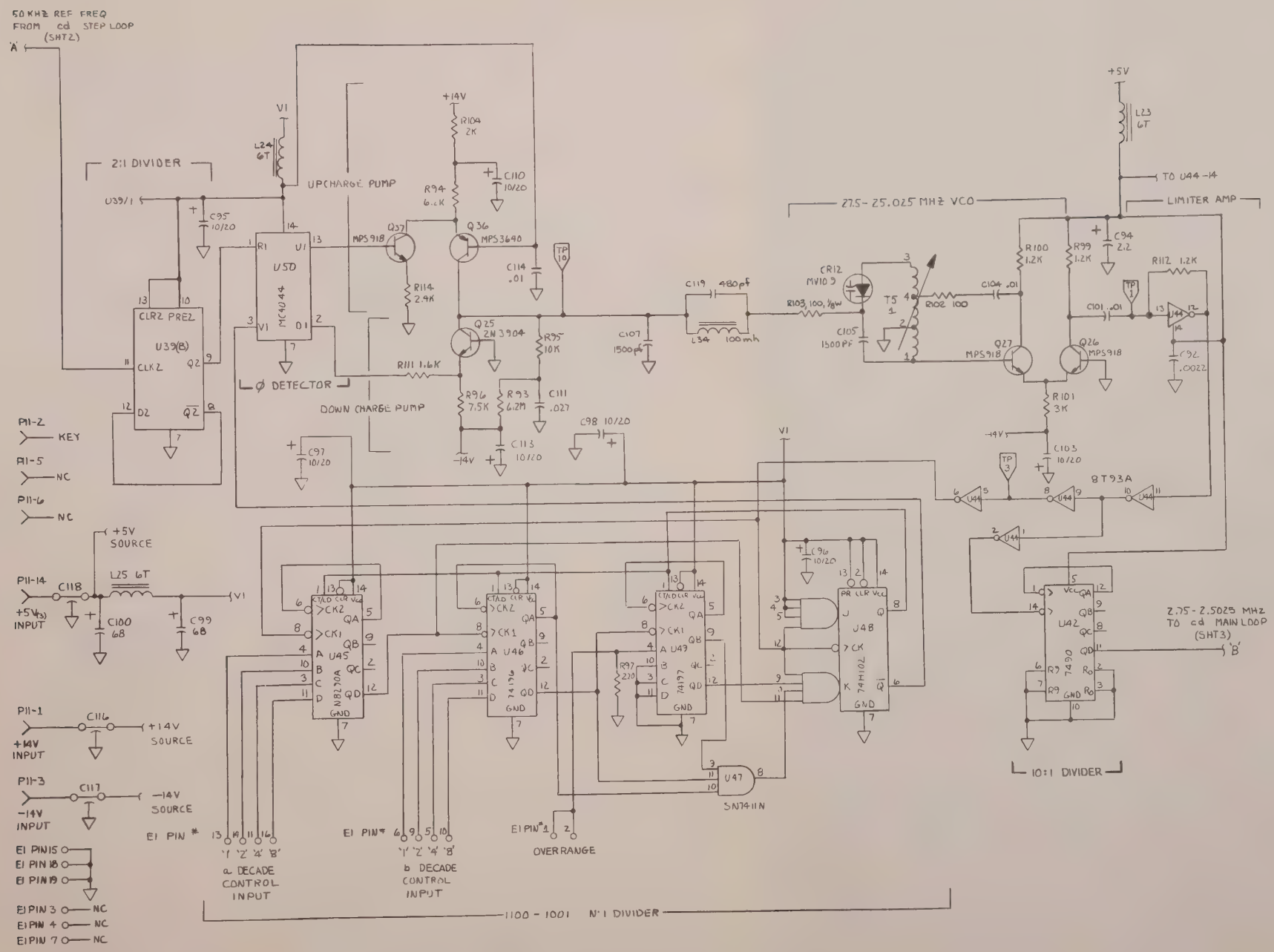


Figure 8-4. 6-Digit Generator PCB Assembly (Component Location) (Sheet 1 of 6)



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   - (A) ALL CAPACITOR VALUES ARE IN MICROFARADS.
   - (B) ALL RESISTOR VALUES ARE IN OHMS
   - (C) ALL INDUCTOR VALUES ARE IN MICROHENRIES.
   - (D) ALL GATE IC'S: PIN 14 - FILTERED +5V
     PIN 7 - GND
2. CR1 & CR2 ARE A MATCHED PAIR.
   CR7 & CR10 ARE A MATCHED PAIR.
3. SEE 6010A-1602 FOR REF DES DRAWING.

LAST NO. USED	OPEN
R116	R25,26,29,54,55,60,72,76,77,78,106
U50	U17,20,27,31,40,41,43
Q39	Q1,2,10,11,28,29,32,33,34,35
L33	L28,29,30,31
CR12	CR6,11
C118	C3, ,106,108,109
T5	

Figure 8-4. 6-Digit Generator PCB Assembly (ab Step Loop) (Sheet 2 of 6)

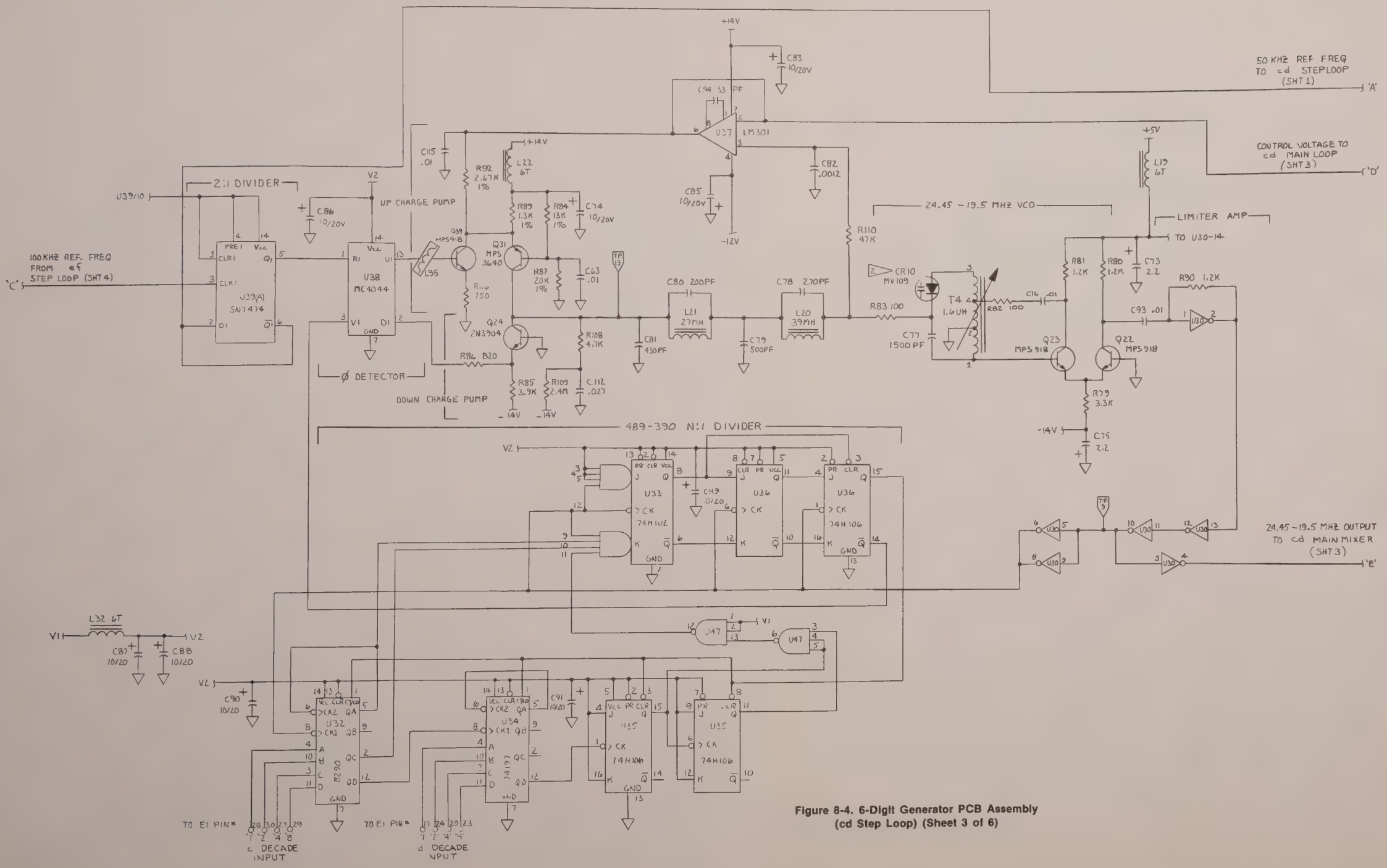


Figure 8-4. 6-Digit Generator PCB Assembly (cd Step Loop) (Sheet 3 of 6)

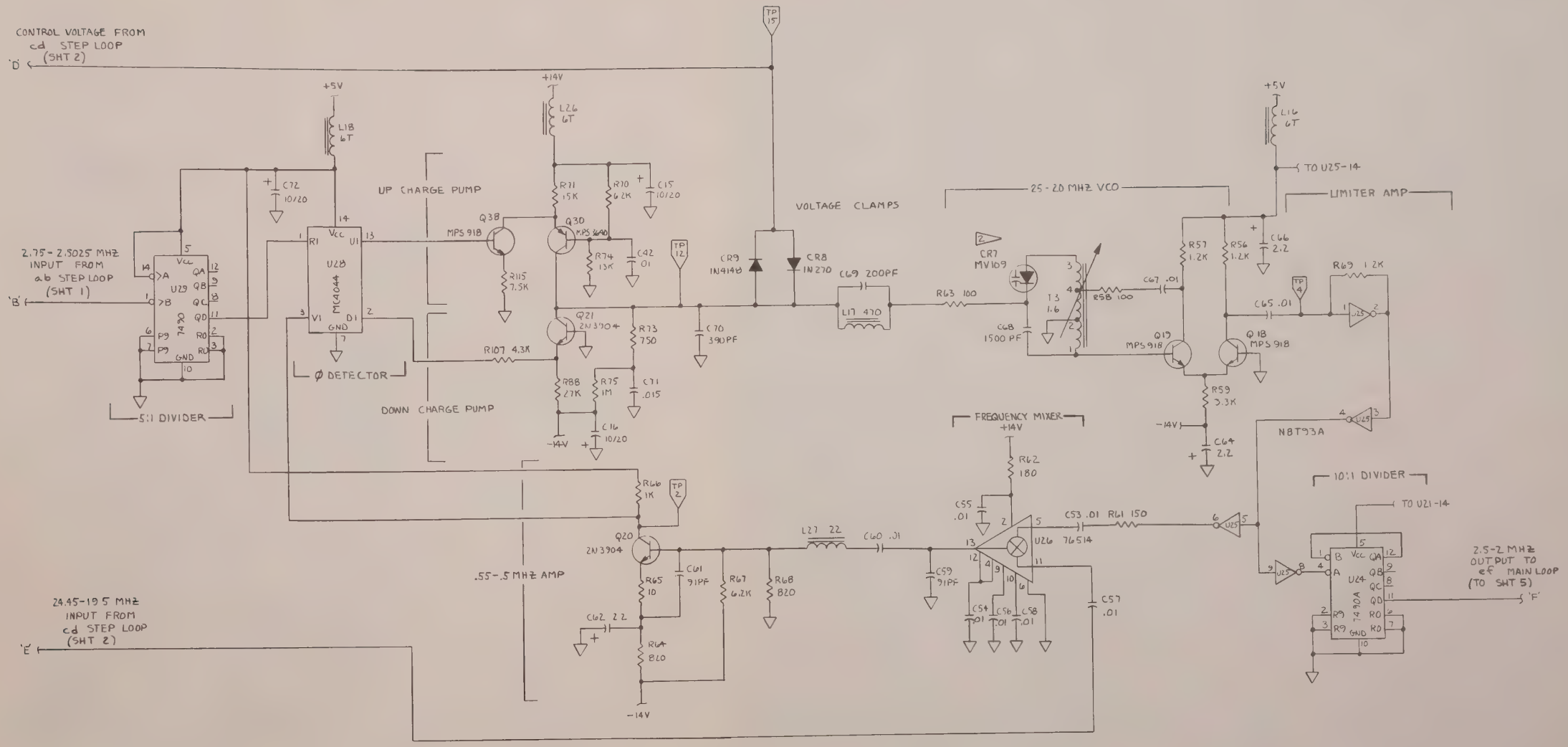


Figure 8-4. 6-Digit Generator PCB Assembly (cd Main Loop) (Sheet 4 of 6)

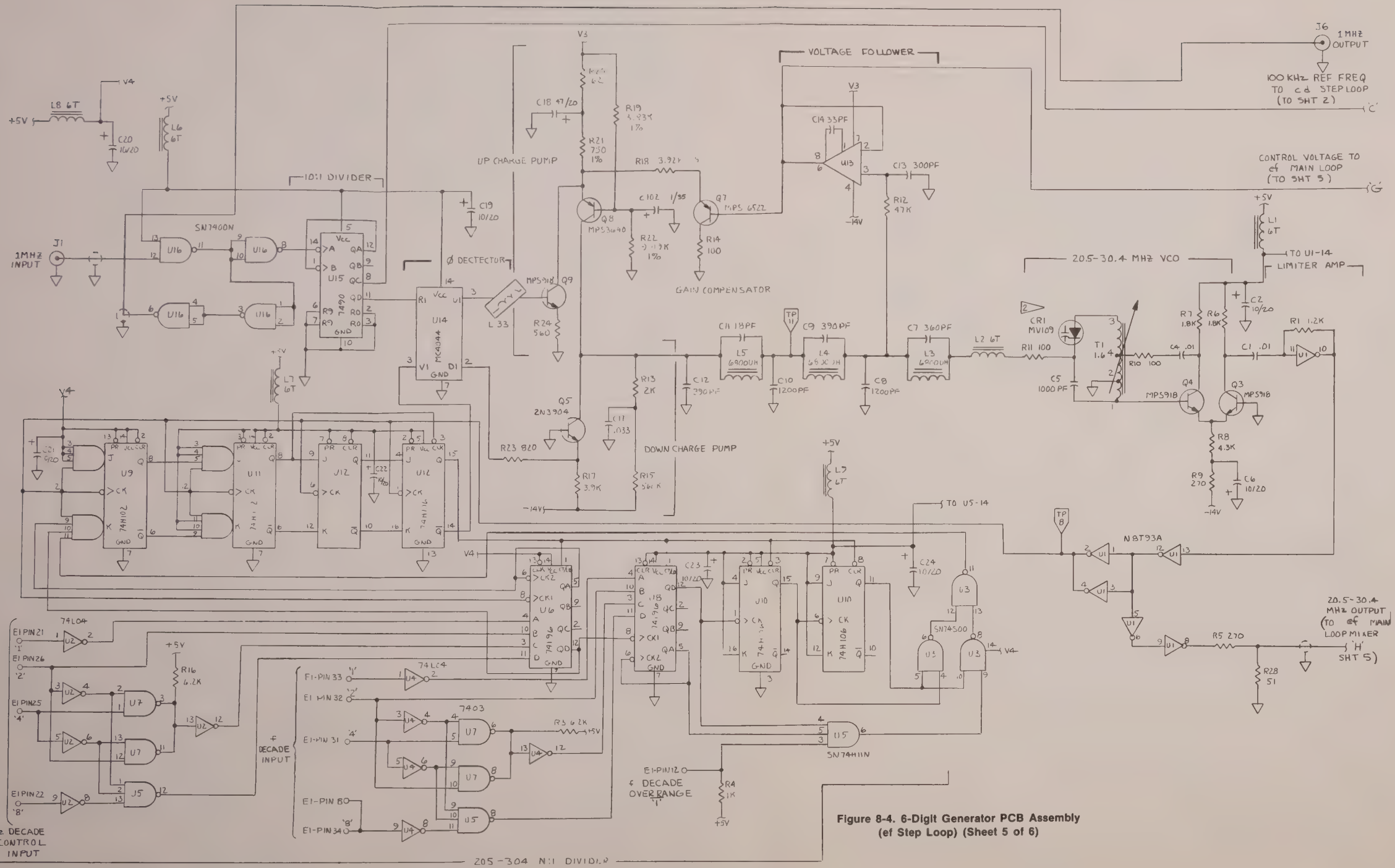


Figure 8-4. 6-Digit Generator PCB Assembly (ef Step Loop) (Sheet 5 of 6)

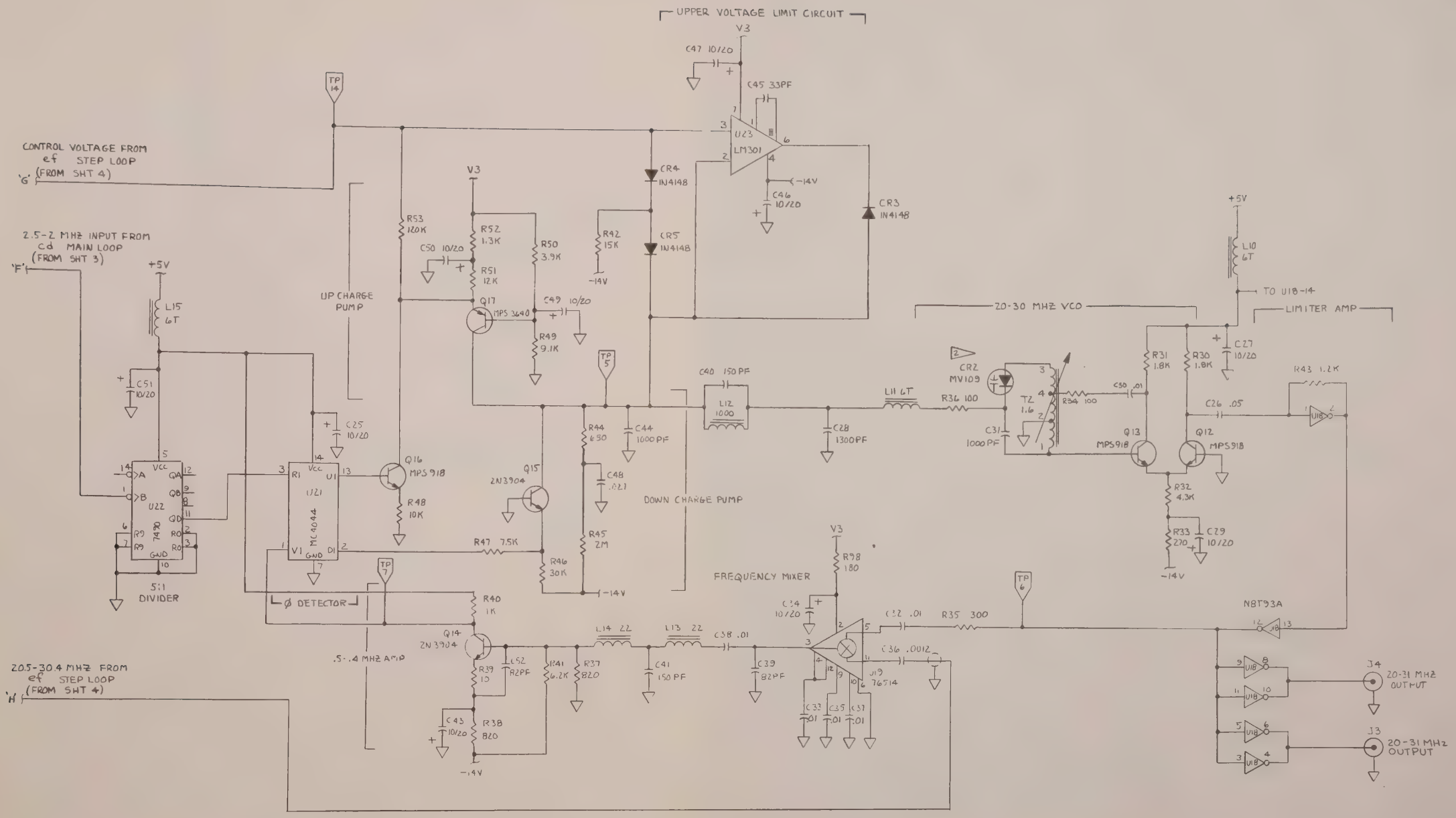


Figure 8-4. 6-Digit Generator PCB Assembly (ef Main Loop) (Sheet 6 of 6)

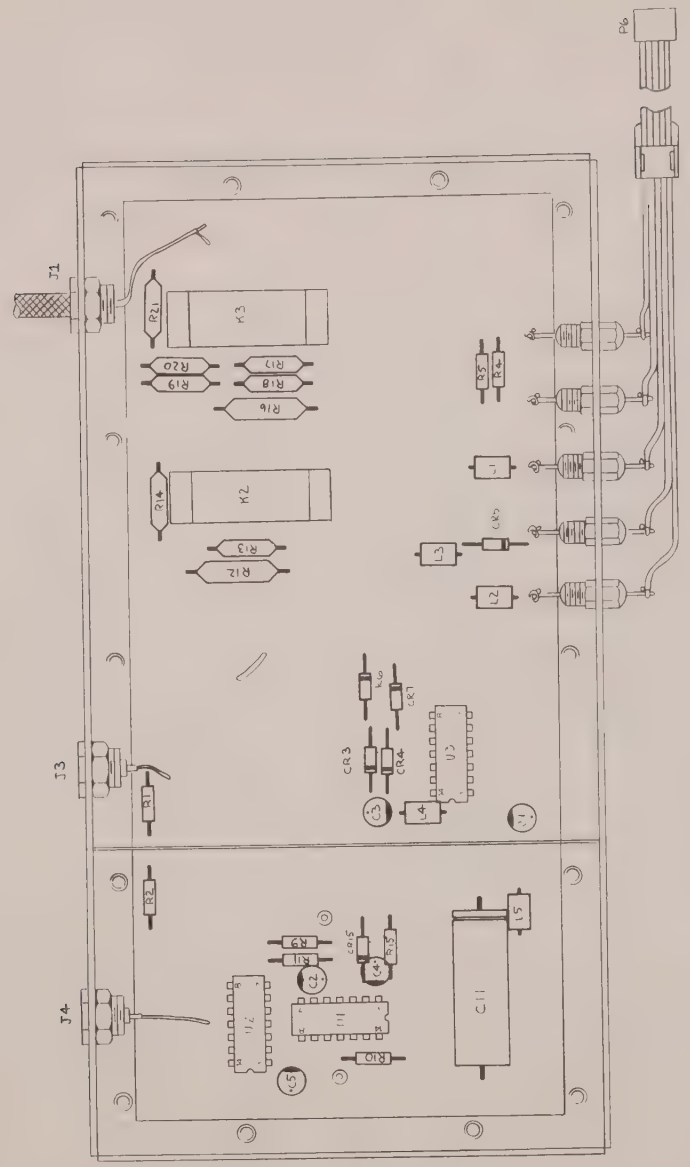


Figure 8-5. Attenuator and Square Wave Output PCB Assembly (Component Location) (Sheet 1 of 2)

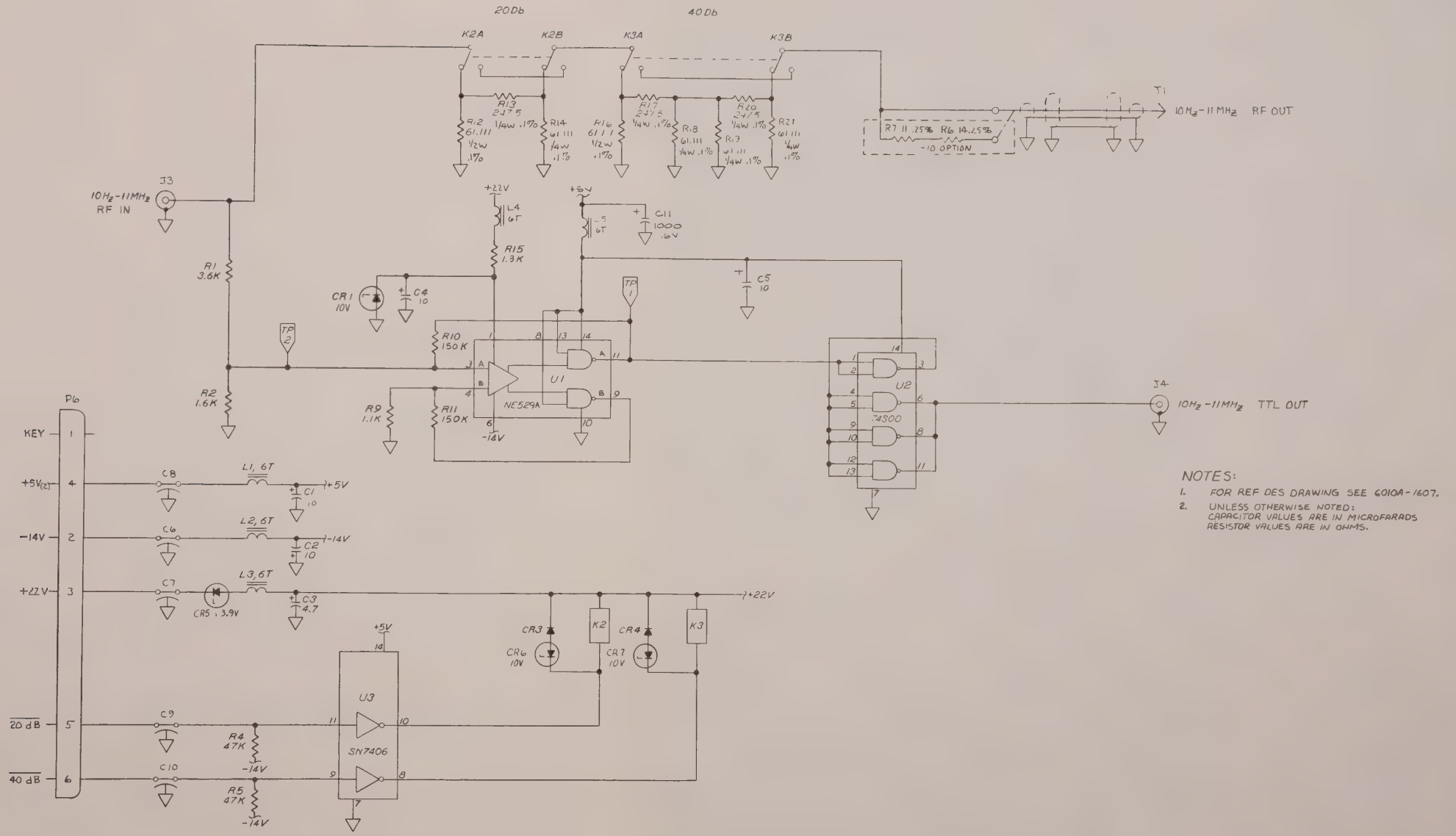


Figure 8-5. Attenuator and Square Wave Output PCB Assembly (Sheet 2 of 2)

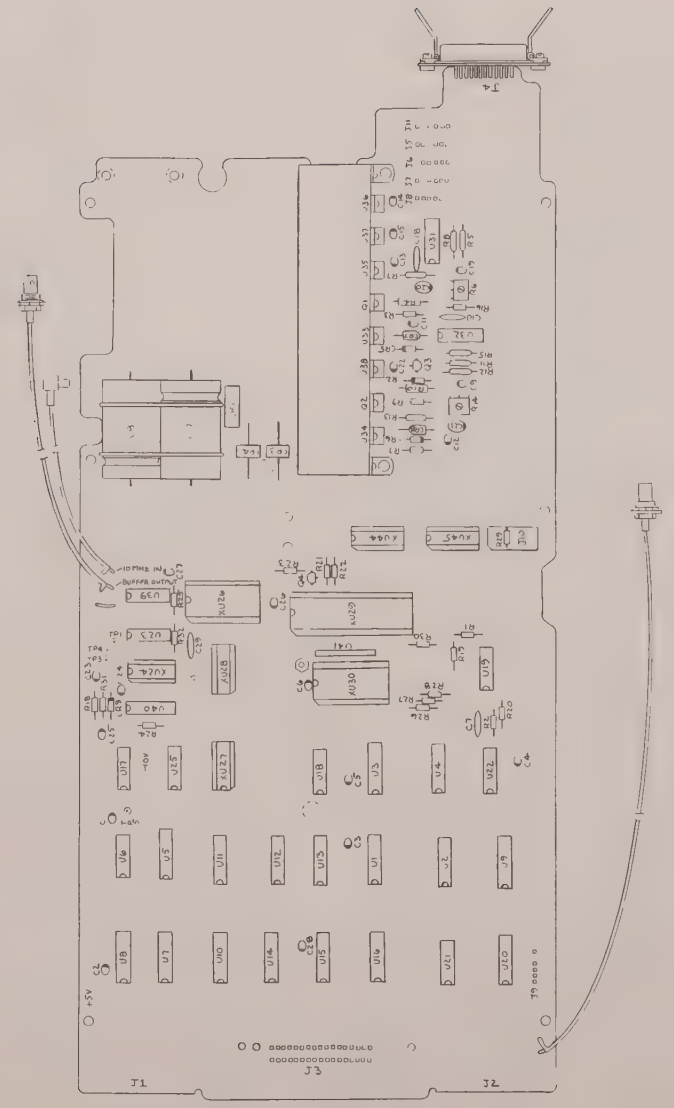


Figure 8-6. Main PCB Assembly Component Location (Sheet 1 of 4)

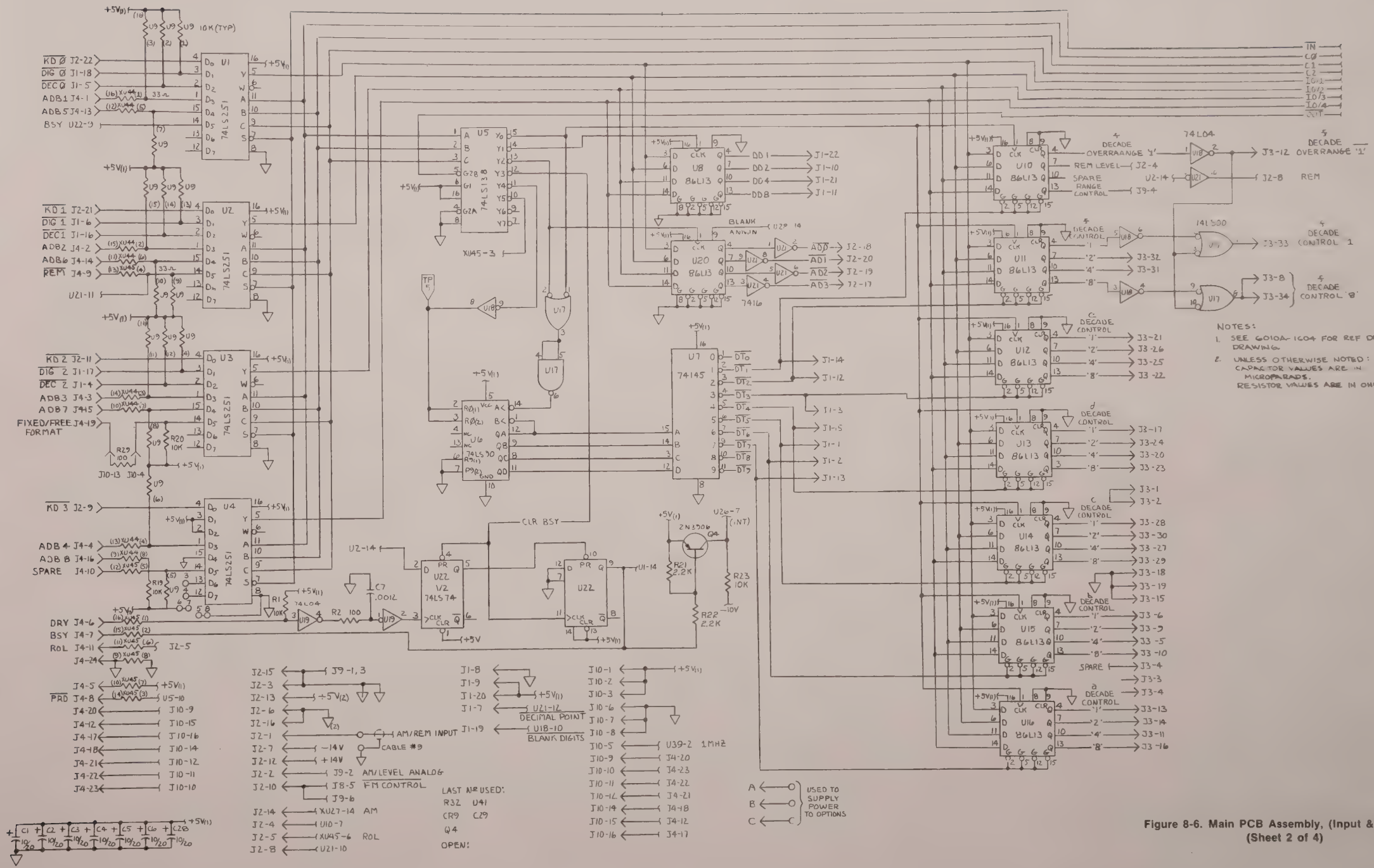


Figure 8-6. Main PCB Assembly, (Input & Outputs) (Sheet 2 of 4)

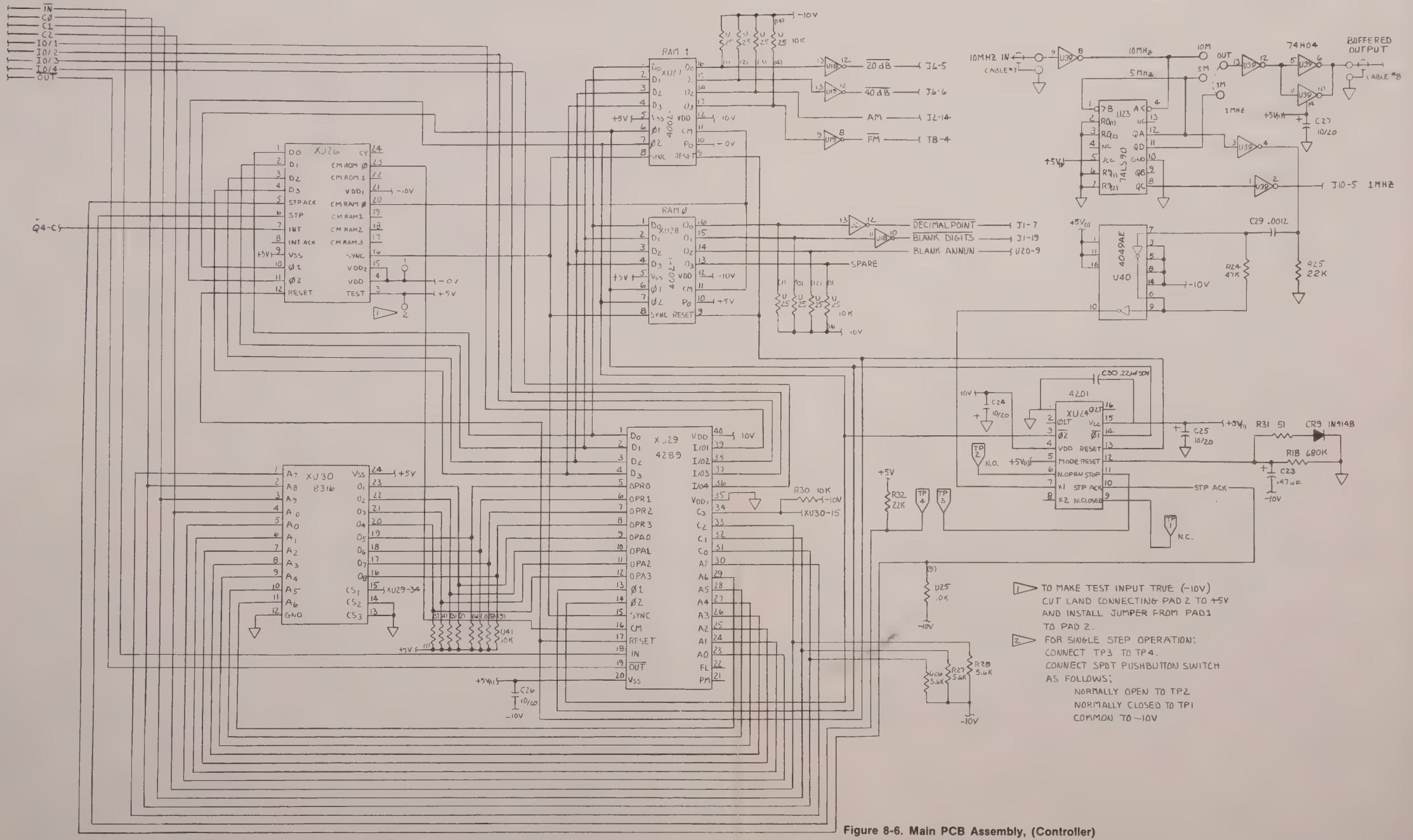


Figure 8-6. Main PCB Assembly, (Controller) (Sheet 3 of 4)

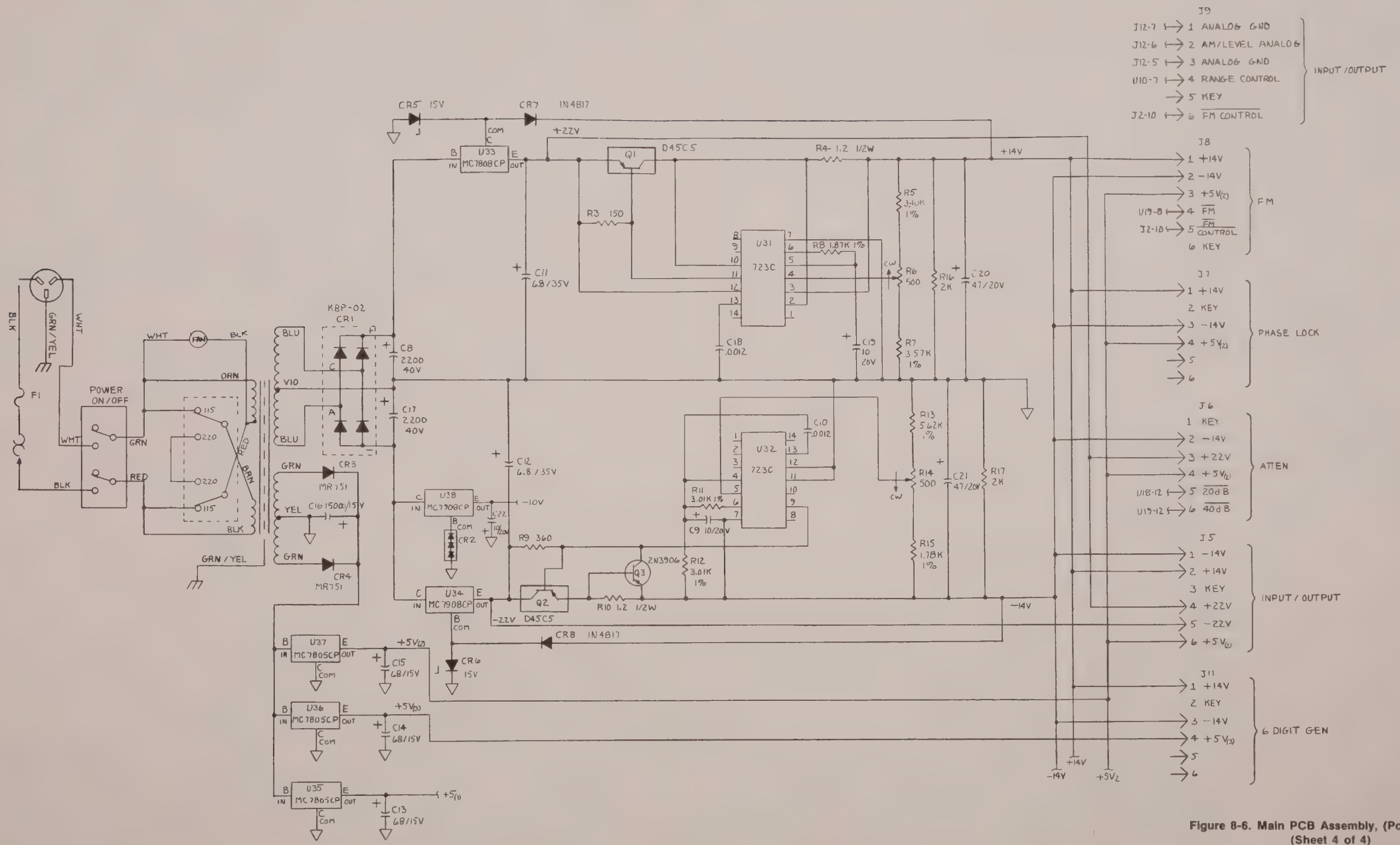


Figure 8-6. Main PCB Assembly, (Power Supply) (Sheet 4 of 4)

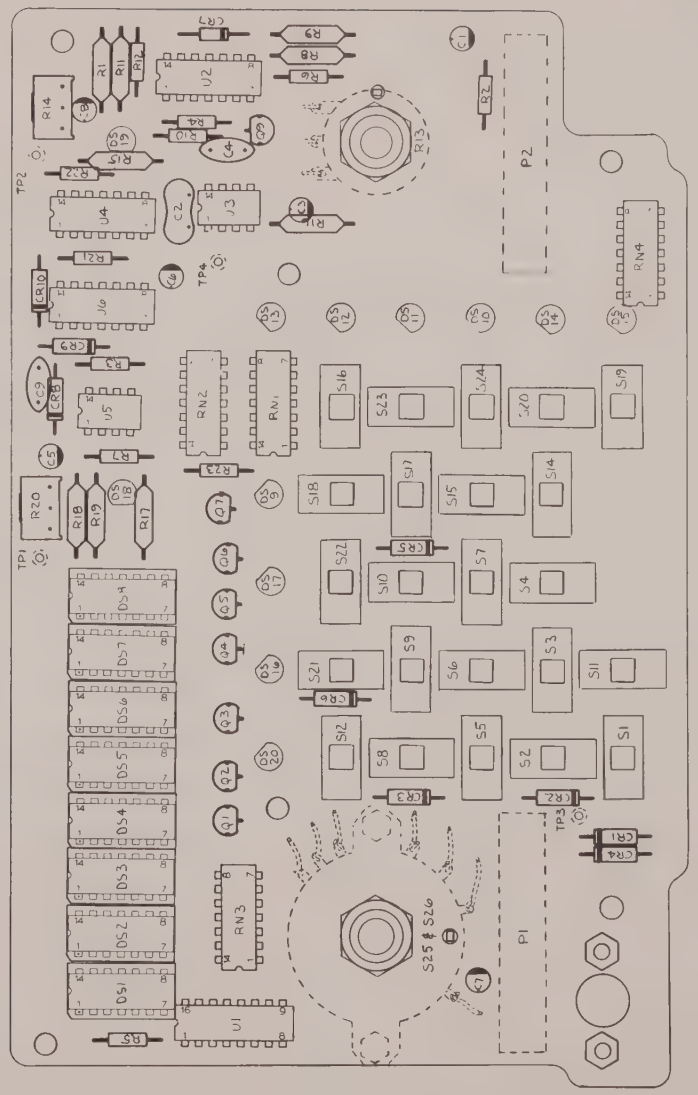


Figure 8-7. Front Panel PCB Assembly Component Location (Sheet 1 of 2)

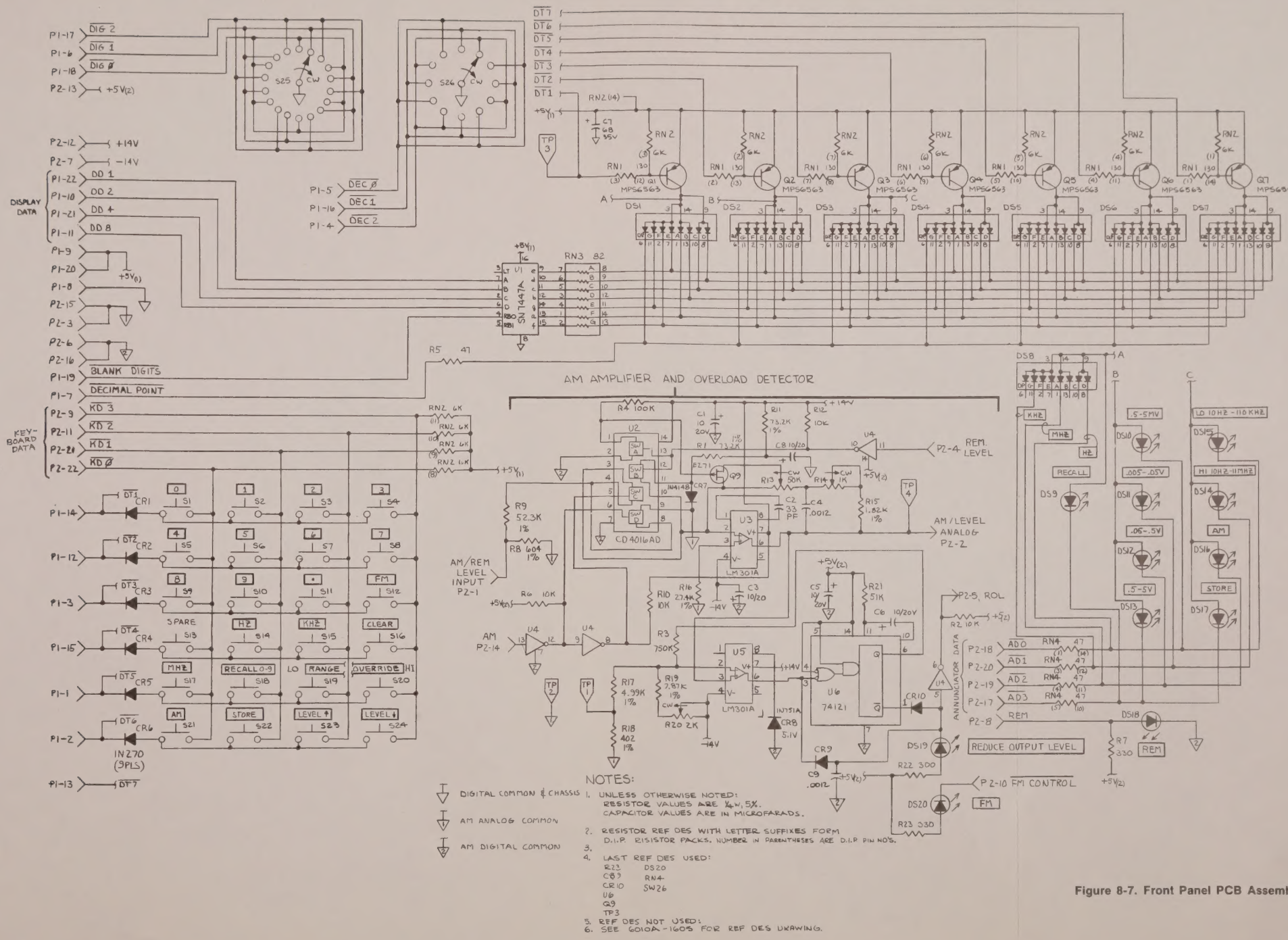


Figure 8-7. Front Panel PCB Assembly (Sheet 2 of 2)

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